COMMODORE USERS

Ahoy!

$2.95/ CAN. $3.35 DECEMBER 1987



Ahoy!

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Cover art by James Regan and Henry C. Blazer; photos by Michael R. Davila

ISSUE NO. 48 DECEMBER 1987

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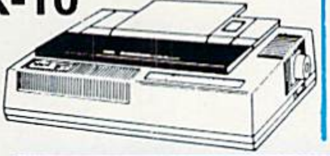
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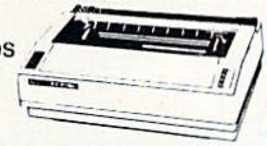
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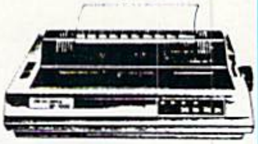
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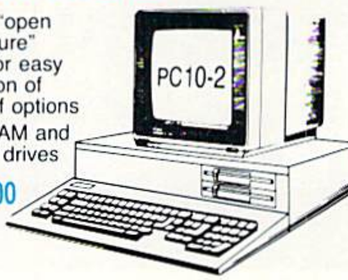
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VIEW FROM THE BRIDGE

Feminists across the country, unite—but not in our lobby, please! Though the banner headline on this month's cover sounds incredibly sexist, it's not intended as such. We tossed around many unisex alternatives, but none had the ring of "The Thinking Man's Commodore Magazine." Rather than sacrifice alliteration and phrase recognition, we decided to go chauvinist and take our lumps. But we promise—if any reader manages to come up with a better variation, he can write all our cover blurbs from now on! (Did we say *he?* We meant *he* or *she!* That is—*she* or *he!*)

We're certain there'll be no controversy about the insides of the December issue of *Ahoy!:*

• In a way, *Ahoy!* is about nothing *but* artificial intelligence—the only type of intelligence a computer could possess. But this month's *Rupert Report* concerns AI in its narrower sense, as the computer simulation of human thought processes. Dale Rupert's *Learner* will teach you how your Commodore can acquire and organize knowledge. (Turn to page 32.)

• The greatest artists in any field borrow from tradition. And James C. Hilty drew from one of the true arcade classics—*Congo Bongo*—in creating this issue's *Cliffhanger* for this issue. (Turn to page 31.)

• A certain nationally advertised pizza chain offers you a free pie if they don't get to your door within 30 minutes. Cleve Blakemore's *Pizza Boy* provides C-128 owners excellent training for a career with that organization, as you dodge motorists and mongrels to deliver the greasy goods on schedule. (Turn to page 22.)

• If that's not quite the career you had in mind, how would you like to be a police sharpshooter? Curtis Kaylor's *Silhouette* trains your trigger finger, first at a rifle range, then at a mock village. (Turn to page 18.)

• And if you excel at small arms fire, Curtis will move you up to the big guns! In *Warship*, you and another player take turns shelling vessels on a split-screen display. (Turn to page 16.)

• This month like last month, Buck Childress contributes three utilities. *Redirect*, in C-64 and C-128 versions, lets you customize your disk directories. (Turn to page 70.) *Sprite-On* tells a programmer the horizontal and vertical positions of a sprite as it moves around the screen. (Turn to page 70.) And *Take Two* undoes the accidental destruction that certain commands can cause. (Turn to page 49.)

• As an *Ahoy!* reader, you're likely to identify with Richard Herring's confession this month that "long ago I gave up any delusion that I had enough will power to resist buying as much RAM as a computer would hold." And with Morton Kevelson's assertion in this issue that "As with RAM, a computer can never have enough I/O." If you are in fact the type of user who views system expansion as a kind of manifest destiny, you've come to the right place. Richard reviews MicroBotics' 512K RAM Expander, a lower cost alternative to Commodore's own, in this month's *Amiga Section*. (Turn to page 53.) Morton profiles the Microtroll and Turbo Processor, two noteworthy expansion port devices for the 64, in our *Reviews* section (turn to page 63), along with expanding your mind in *The Ins and Outs of the C-64/128 Expansion Port*. (Turn to page 59.)

December, of course, is the perfect month in which to expand your system. If a letter to the north pole doesn't do the trick, print out some banner-sized hints to plant inconspicuously around the house. But while you're doing it, don't lose sight of what this time of year is really about—Peace on Earth, and good will toward m—*people!* (Whew!)

—David Allikas

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GEOS CLIP ART, MUSIC

Four new *Diskart* collections of GEOS-compatible graphics—*Diskart 5, 6, 7,* and *Musi-Kit*—have been released at $8.50 each. *Musi-Kit* enables the user to produce sheet music.

Those Designers, 213-427-6742 (see address list, page 12).

LEGAL FORMS

Microlawyer ($59.95) contains over 100 forms which enable the C-64 or Amiga user, in conjunction with legal advice, to prepare a wide range of legal documents for personal, business, and corporate use. Included are power of attorney forms, premarital agreements, affidavits, leases, loan and mortgage forms, real estate contracts, and more.

Progressive Peripherals & Software, Inc., 303-825-4144 (see address list, page 12).

BETTER BUTCHER

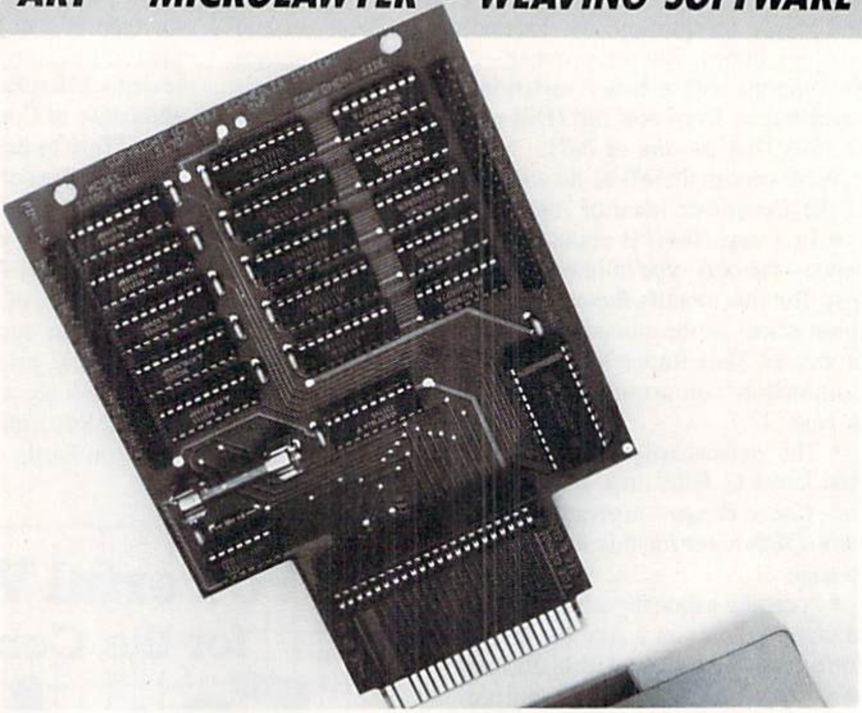
Butcher version 2.0, an upgrade of the Amiga graphics utility reviewed in the September *Ahoy!*, will incorporate support for pages larger than the screen, a spare page, user-defined halftone screens, printouts of pixel counts, color cycling, counting of clipped screen portions, enhanced mosaic operations, readouts on proportional gadgets, and numerous color effects. Price will be $37; the upgrade price, not set at press time, will be under $10.00.

Eagle Tree Software (see address list, page 12).

AMIGA WEAVING

Weave-It ($69.95) allows practitioners of the art to plan designs on an Amiga in med-res format, utilizing any 8 of the Amiga's 4096 colors. The user is permitted up to 12 harnesses and 14 treadles, and can design warp or weft stripes in up to six colors. (If it's any consolation, we're probably more lost than you are.) Colors, threading, tie-up, and treadling can be changed at any point. A database of designs can be created with *Superbase,* and modifications can be made with *Deluxe Paint.*

Joyce I. Peck, 604-752-3364 (see address list, page 12).



The SS100 Plus' cartridge expansion socket facilitates use of a ROM or EPROM cartridge for control applications. READER SERVICE NO. 209

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Schnedler Systems' SS100 Plus Simplified Digital I/O Board ($119) plugs into the C-64 or 128 user port to provide 40 TTL-compatible digital input lines organized as five 8-bit ports, and 40 entirely separate switched output lines also organized as five 8-bit ports. A ROM cartridge socket is included on the board, eliminating the need for an expansion motherboard and making it possible to create a dedicated autostart controller without a disk drive. I/O lines are controlled through memory mapped ports, each accessed via a single BASIC statement.

As we pointed out last month and now reiterate, Schnedler Systems is not to be confused with Schneider Software (see *Flotsam*, page 30, November).

Schnedler Systems, 704-274-4646 (see address list, page 12).

AMIGA 500 HARDWARE

Three Amiga 500 products by C Ltd:

The Controller 500 ($199.95), similarly to the previous version for the 1000, allows all "Small Computer Systems Interface" (SCSI) products to communicate with the Amiga 500. This includes most current SCSI hard drives, plus future devices like CD-ROMs and WORM optical devices.

The RGB Video Adapter ($49.95) adapts the Commodore 1702 color

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Kracker Jax Volumes 1-6 EACH	17
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PERSONAL

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AMIGA

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Talking Coloring Book (JMH)	24
Superbase (Progress)	119
TV Text (Brown W)	79
Videoscape (Aegis)	159
Wordperfect	299
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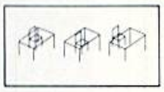
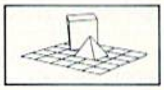
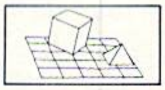
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Reader Service No. 172

monitor for use with the Amiga 500. Connecting through the 500's RGB port, it allows full 80-column display.

The Internal RAM Expansion Card ($199.95) offers 512K plus a built-in clock calendar, a 4-layer board, and socketed RAM chips for easy serviceability.

C Ltd (see address list, page 12).

EDUCATIONAL PROGRAMS

With *Rainy Day Games* ($29.95), one to four C-64 users aged 4 and up can take on Ted Bear in interactive rounds of Concentration, Old Maid, and Go Fish. Action-oriented graphics make words interesting and reinforce their meaning.

Baudville, 616-957-3036 (see address list, page 12).

Wordmaze ($49.95) helps students from grades 3-12 develop vocabulary and spelling skills as they search for words in a block of scrambled letters. The program takes words from a list and places them randomly in a matrix or maze in any of eight directions. Word lists relating to various subject areas can be entered. Included are a teacher's guide and activity sheets.

Mindscape, 312-480-7667 (see address list, page 12).

The six Sesame Street titles developed some time ago by the Children's Television Workshop have been rereleased at $9.95 by Hi Tech Expressions. The programs are *Astro-Grover* (numbers), *Ernie's Magic Shapes* (shapes and colors), *Big Bird's Special Delivery* (matching), *Pals Around Town* (get-to-know-the-neighborhood), *Ernie's Big Splash* (problem solving), and *Grover's Animal Adventures* (animal environments).

Hi Tech Expressions, 800-848-9273; in FL 305-584-6386 (see address list, page 12).

Davidson has released workbooks for use with their *Math Blaster!* and *Word Attack!* software. Price is $4.95 each.

Davidson & Associates, 800-556-6141 or 213-534-4070 (see address list, page 12).

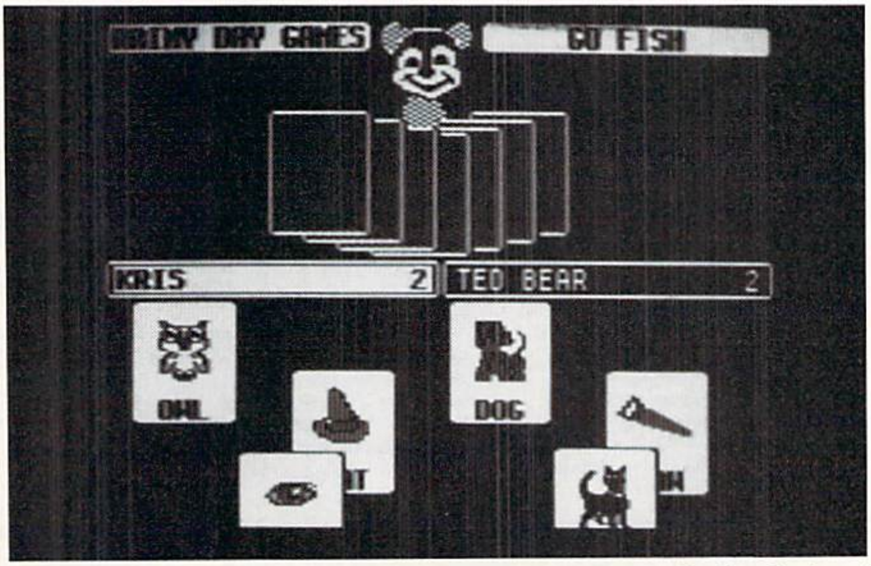
PICTURE THIS

Postcards ($24.95) lets the C-64 user create same, as well as invitations, notes, and all manner of personalized messages. The program's clip art collection contains a variety of bizarre animals, people, and objects, plus a library of backdrops. Messages can be totally original, or composed of the supplied phrases.

Activision, 415-960-0410 (see address list, page 12).

'88 & '89 TAX PROGRAM

Future-Tax ($39.95) will calculate your income tax for 1988-89 based on the 1986 Tax Reform Act. The program can be used to decide when to shift income or deductions to future years, when to sell assets, and when to contribute to an IRA or make charitable



Ted Bear's **Rainy Day Games** *helps small persons to develop keyboard familiarity and concentration skills.* *READER SERVICE NO. 208*

contributions. Calculations are automatic, with the new tax rates built in. Versions are available for the C-128, C-64, and Plus/4.

Taxaid Software, Inc., 218-834-5012 (see address list below).

FROM THE SPIRIT WORLD

Three 64 releases from Free Spirit: *Masterpieces I* (Flags of the World) consists of the flags of 180 countries, which may be seen onscreen or dumped to a 1525-compatible printer. It is the first in a planned series of hi-res drawings of famous objects and works of art.

English and Scottish Songs, a collection of 16th and 17th century folk tunes, precedes each song with its historical background and displays the words to each as the music plays. Selections include "My Heart's in the Highlands," "British Grenadier," and "Barbara Allen."

Best of Scott Joplin, Volume II, tenth in Lorne Strider's classical music series, displays biographical information onscreen during the songs.

Each non-copy protected disk is $9.95, including shipping and handling.

Free Spirit Software, Inc., 312-352-7323 (see address list below).

GOT A MINUTE?

Survey-Master ($29.95) performs marketing survey analyses on the C-64 and summarizes results in printed form. The user chooses the type of report, then inputs information like confidence level desired, total sample size, number of respondents, and size of total population from which the sample was taken. Reports contain data such as percentage of responses by option (Brand A, Brand B, etc.), recap of population and sample criteria, standard error of percentage, and confidence interval.

Strategic Marketing Resources, 314-256-7814 (see address list below).

GAMES

From Electronic Arts for the 64:

An interactive novel written by the famous science fiction writer, *Thomas M. Disch's Amnesia* ($39.95) begins with the main character walking in a

Companies Mentioned in Scuttlebutt

Abacus Software
P.O. Box 7219
Grand Rapids, MI 49510
Phone: 616-241-5510

Activision, Inc.
2350 Bayshore Parkway
Mountain View, CA 94043
Phone: 415-960-0410

Artworx Software Company
1844 Penfield Road
Penfield, NY 14526
Phone: 716-385-6120

Baudville
1001 Medical Park Drive S.E.
Grand Rapids, MI 49506
Phone: 616-957-3036

Broderbund Software, Inc.
17 Paul Drive
San Rafael, CA 94903-2101
Phone: 415-479-1170

C Ltd
723 East Skinner
Wichita, KS 67211
Phone: 316-267-6321

Davidson & Associates, Inc.
3135 Kashiwa Street
Torrance, CA 90505
Phone: 213-534-4070; in CA 800-556-6141

Eagle Tree Software
P.O. Box 164
Hopewell, VA 23860

Electronic Arts
1820 Gateway Drive
San Mateo, CA 94404
Phone: 415-571-7171

Free Spirit Software, Inc.
538 S. Edgewood
LaGrange, IL 60525
Phone: 312-352-7323

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Plantation, FL 33313
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4601 North 9th
McAllen, TX 78504
Phone: 512-682-9598

MIDImouse Music
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Rhododendron, OR 97049
Phone: 503-622-5451

Mindscape, Inc.
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Phone: 312-480-7667

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Strategic Simulations
1046 N. Rengstorff Avenue
Mountain View, CA 94043
Phone: 415-964-1353

Taxaid Software Inc.
606 Second Avenue
Two Harbors, MN 55616
Phone: 218-834-3600

Those Designers
3330 Lewis Avenue
Signal Hill, CA 90897
Phone: 213-427-6742



Reader Service No. 183

hotel room in Manhattan. He doesn't know who he is, but soon learns that a strange woman wants to marry him, someone is trying to kill him, and the state of Texas wants him for murder. The C-64 gamer must discover the character's identity as he visits up to 4000 separate locations in Manhattan, including 650 streets and the subway system.

Russia: The Great War in the East 1941-1945 ($39.95), designed by Strategic Studies Group, lets players reenact the conflict or observe it as it actually took place. Econommic and military parameters can be varied, and the battle can be begun at any point within the four years.

And from EA for the Amiga:

Leisure Suit Larry in the Land of the Lounge Lizards ($49.95) sends the adult gamer on a romp through the singles scene in the fictional town of Lost Wages. Larry's nerdy looks and lack of money complicate his task of seducing the woman of his dreams–he may have to win big at blackjack or slots to finance his endeavor.

Based on the Disney movie, *The Black Cauldron* ($39.95) centers around the kettle created by an evil king's curses. Whoever uses it for evil will be all-powerful; so as Taran, former assistant pig keeper, you must find it and destroy it before the wicked Horned King does.

Electronic Arts, 415-571-7171 (see address list, page 12).

Borodino: 1812, Napoleon in Russia ($59.95) recreates the three-day battle, with eight historical and what-if scenarios that range in playing time from 15 minutes to 4+ hours. Variable speed control allows for stop action, true real-time play, and degrees of accelerated real-time.

KRENtek Software, 512-682-9598 (see address list, page 12).

Artworx has taken the wraps off two more data disks for use with *Strip Poker* for the Amiga. *#4* and *#5* each contain two female players, and each retails for $19.95.

Artworx Software Company, Inc., 716-385-6120 (see address list, page 12).

Strategic Simulations had no way of knowing that Oliver North would fade from the limelight faster than Howard the Duck. So they prepared a sheet of guidelines for running Ollie as a candidate in *President Elect–1988 Edition.* A copy can be had by writing SSI.

Strategic Simulations, Inc., 415-964-1353 (see address list, page 12).

From Activision:

Based on the leading speed plane of the 1930's, Steve Cartwright's *GeeBee Air Rally* offers 16 race courses, each with a different scrolling 3-D background. $29.95 for the 64, $39.95 for the Amiga.

Containing over $500 in special offers and discounts, Activision's *Great Good Deals Giveaway Bonus Book* will be given away in specially labeled software packages, and dispensed free to anyone who writes to Activision at Dept F80, c/o 3605 El Camino Real, Suite 40, Santa Clara, CA 95051.

Activision, Inc., 415-960-0410 (see address list, page 12).

Superbike Challenge ($19.95) sends C-64 gamers around 12 famed Grand

Continued on page 69

The Mission is Vital. The Odds are Against You.



You're one of the elite . . . parachuting alone behind enemy lines. The enemy controls the terrain, hidden in bunkers and machine gun nests . . . you may be surrounded. You might complete the mission if you crawl through the ravine and approach from the rear . . . or maybe a frontal attack will take them by surprise.

MicroProse has broken new ground with **AIRBORNE RANGER**, the quality action game where tactical thinking and lightning reflexes determine your fate. Your missions will vary as much as the climate and terrain. Slip silently into position to rescue prisoners trapped in "tiger pits" from a P.O.W. camp, or throw caution to the wind and try to destroy a key munitions dump in the desert. But watch out . . . enemy troops can attack from any direction.

The action is fierce as you control one soldier's battle against overwhelming odds. You'll need skill and strategy to outmaneuver your enemy, plus courage and some luck to make your escape. Along the way, search out that hidden cache of weapons and first aid supplies . . . you'll probably need them.

AIRBORNE RANGER

AIRBORNE RANGER is a fast-paced, quick-to-learn game with 12 desperate missions in three different regions of the world. You'll be running, walking and crawling across full-scrolling, 3-D terrain. Arm yourself with an M-16 assault rifle, bayonet, LAW rocket (Light Antitank Weapon) or time bomb, but be wary of enemy submachine guns, antitank rockets, robot minitanks, minefields and flamethrowers.

AIRBORNE RANGER . . . More than just a great game. It's an adventure.

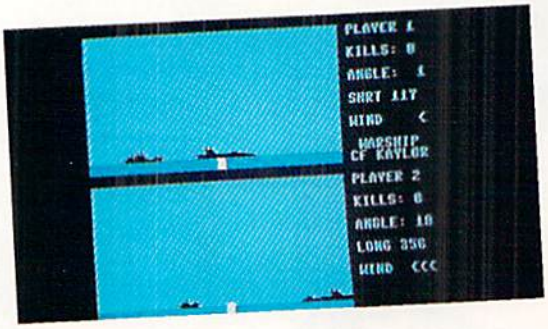
AIRBORNE RANGER is available from a "Valued MicroProse Retailer" (VMR) near you. Call us for locations! For Commodore 64/128, IBM-PC/compatibles and Apple II+/e/c. Call or write for specific machine availability, and for MC/VISA orders if product not found locally.



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Reader Service No. 147

WARSHIP
For the C-64
By Curtis F. Kaylor



You turn until the ship is in your sights, then another 20 degrees west to account for wind. Your last shot was 300 meters short, so you raise the cannon 20 degrees. You recheck your calculations and then, crossing your fingers, hit the trigger. The shell arches gracefully through the air and...hits!

Warship is a two-player game for the C-64. Type in the program, save it, and run it. A split screen display will appear. On the right side of the display is your view of the water, complete with ships and cannon, and on the left side is the instrument display.

Player one goes first. Pushing the joystick up or pressing the CURSOR UP key raises the cannon, while pushing the joystick down or pressing the CURSOR DOWN key lowers it. The angle of the cannon is shown on the instrument display. The cannon cannot be raised above 45 degrees or lowered below 0 degrees. The higher the angle, the farther the cannon will shoot. Pushing the joystick right or pressing the CURSOR RIGHT key rotates the cannon right, causing the ships to appear to move to the right.

The wind speed indicator uses arrows to show the relative velocity of the wind. The shell will drift in the direction of the wind. If no arrows show, there is no wind. After the shot is lined up, press the fire button or space bar to fire. If the shot was not in line with a ship, the instrument panel will read MISS; otherwise it will read SHORT and a number, LONG and a number, or HIT. SHORT indicates that the shell fell the given number of meters in front of the ship, while LONG indicates that the shell fell the given number of meters beyond the ship. After a player has fired, play goes to the other player and continues until one player has destroyed four ships. □

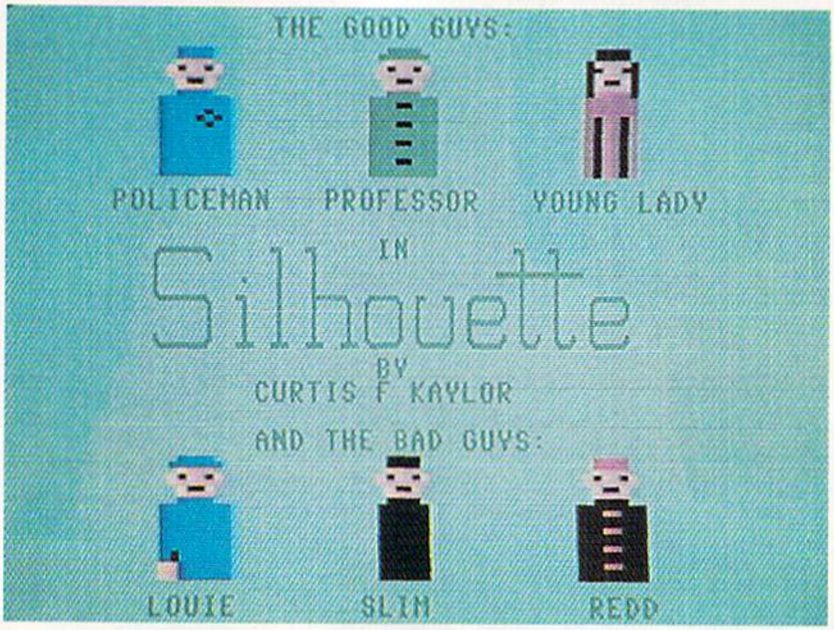
SEE PROGRAM LISTING ON PAGE 102

PHOTO: MICHAEL R. DAVILA

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Reader Service No. 291



For the C-64

Your training at the police academy is almost complete. All that's left is rifle training: first at the rifle range, then at the mock village. Even though you are shooting at wooden silhouettes, you know that every shot counts; for someday you may be in the same situation, but the people will be real.

Silhouette puts you in the position of a rifle trainee: you must shoot all the criminals, known as "the bad guys," while not harming any innocent bystanders, "the good guys." The game requires a joystick in Port 2.

The game is in two parts: a BASIC portion, and the sprite file, which must be entered using *Flankspeed* (see page 89). The BASIC portion expects the sprite file to be named SILSPRITE. If you give it a different name or use cassette, change the LOAD statement in line 100 accordingly.

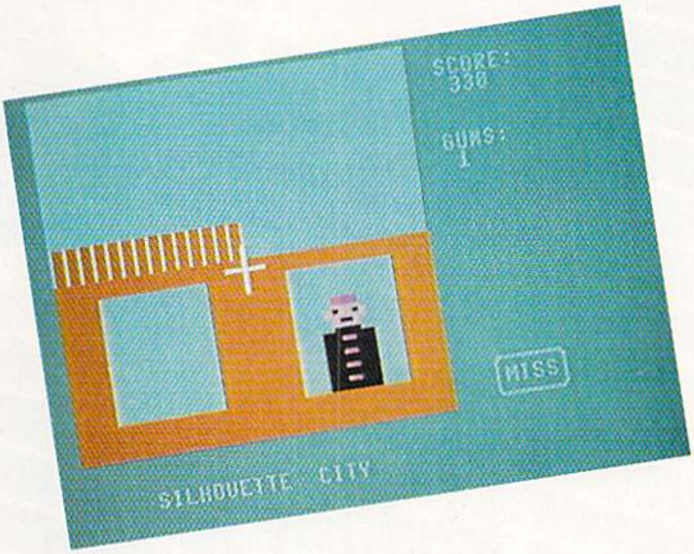
After the program and sprite file have been typed in and SAVEd, run the program. The title screen will appear. After studying the good guys and bad guys to know who is who, press the fire button on the joystick. You will now be at the rifle range. Your crosshairs will appear at the center of the range. After the silhouettes enter the screen and flip toward you, you can move the crosshairs. Push the joystick to the left to aim at the silhouette on the left and right to aim at the silhouette on the right, and center the joystick to aim at the middle silhouette. Press the button to shoot.

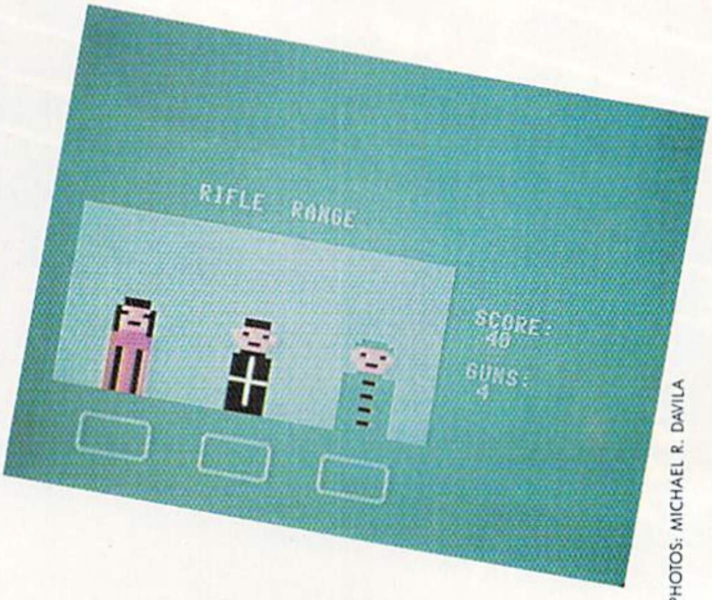
You only get a limited time to shoot, the length of which decreases as the game progresses. If you hesitate too long, the program will register a miss. You start the game with five guns. Each time you hit a good guy or miss a bad guy you lose a gun. When you have no guns left, the game ends.

If you make it past the rifle range you go on to the mock city. Buildings will appear on the screen, and silhouettes will appear in the buildings one by one. The crosshairs rest in the middle of the screen; push the joystick toward a silhouette to aim at it and press the button to shoot it. Remember: shoot the bad guys. If two bads guys appear in the rifle range, you must shoot both of them.

Good luck—I hope you make it onto the force! □

SEE PROGRAM LISTING ON PAGE 94

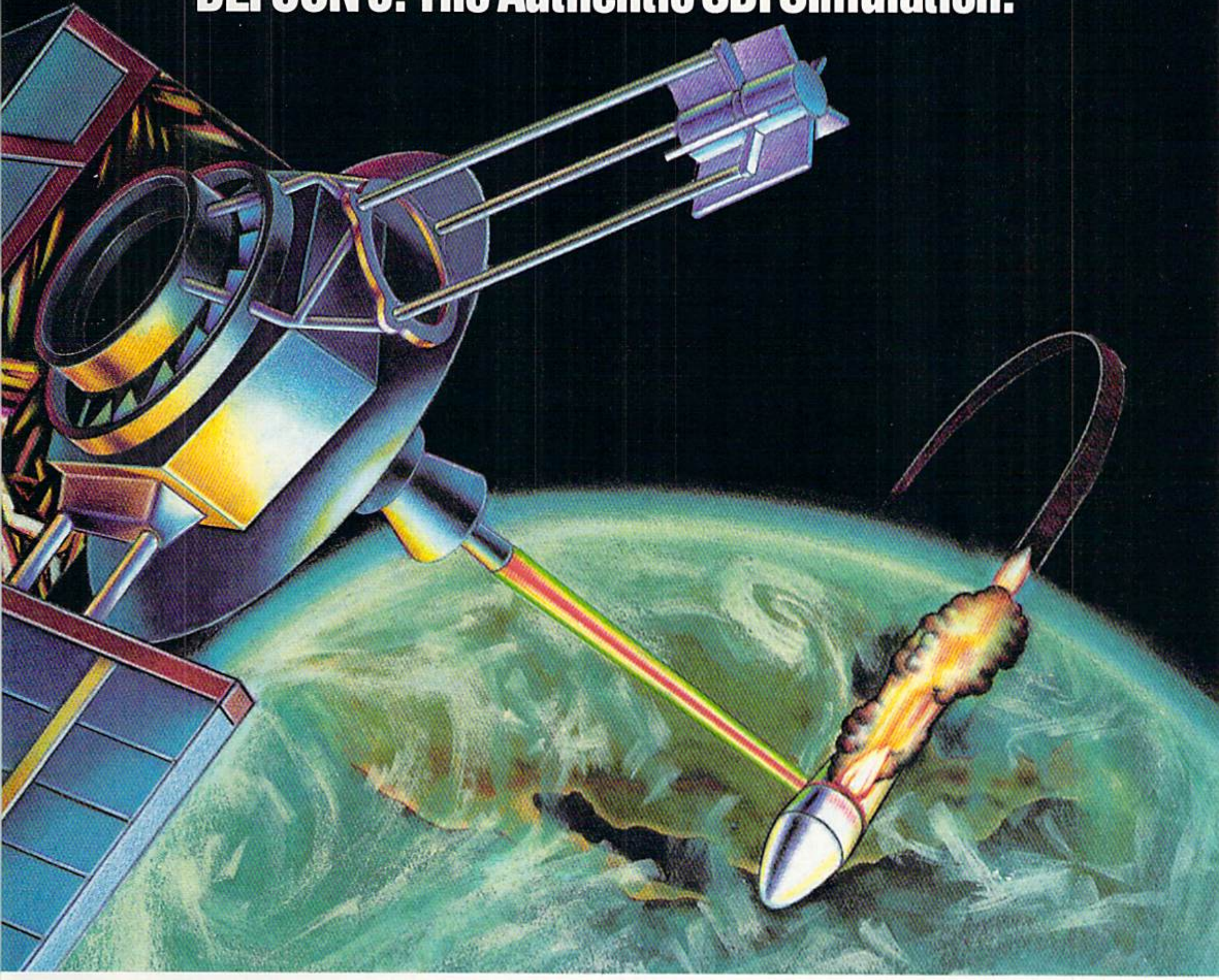




PHOTOS: MICHAEL R. DAVILA

SAVING THE HUMAN RACE CAN BE VERY ENTERTAINING.

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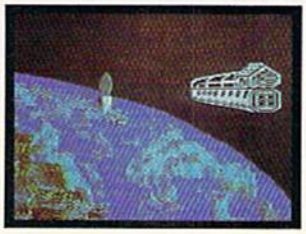


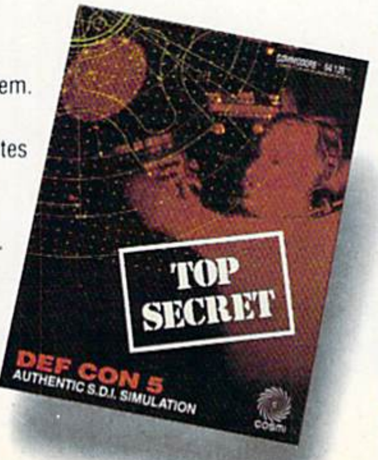
ENEMY LAUNCH DETECTED ALPHA ZULU 13:43.
EXPECT VIOLATION U.S. AIRSPACE 14:09.

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Reader Service No.

ART GALLERY





Art Gallery Disk Sale

Selected *Art Gallery* images are available on disk. Multicolor images are supplied in *Koala* format, while high-resolution images are in *DOODLE!* format. Included are a slide show for easy viewing, along with a bit map dump for your 1525 printer or properly interfaced equivalent. A sample *Art Gallery* disk with slide show and printer dumps is $10; or send a stamped and self-addressed envelope (business size) for a listing of available *Art Gallery* collection disks. Prices shown are for US and Canada. All others add $3 per disk. New York State residents please add appropriate sales taxes. Disks may be ordered from Morton Kevelson, P.O. Box 290260, Homecrest Station, Brooklyn, NY 11229-0005.

Contribute to Ahoy!'s Art Gallery

The *Ahoy! Art Gallery* offers the opportunity for fame and fortune to any and all aspiring Commodore artists. Simply send Morton (see address above) your work on disk indicating the drawing package or file format of the images. Inclusion of a self-addressed post card will guarantee an immediate response. All graphics produced on the C-64/C-128, Plus/4, and Amiga computers are eligible. If your image is published, you will receive a free one-year subscription to *Ahoy!* If you are already a subscriber, your subscription will be extended by one year.

Note that the *Art Gallery* is not a contest. Published pictures are selected in an arbitrary and capricious fashion by the *Ahoy!* Art Director based solely on the artistic merit of the individual images.





Christmas comes but once a year, but when it comes, it brings...a holiday *Art Gallery.* And some other goodies, too, we're sure. In fact, we just got a letter from Santa, who, as you know, keeps his records on a C-64. He's making his list and backing it up twice right now.
See artist credits below.

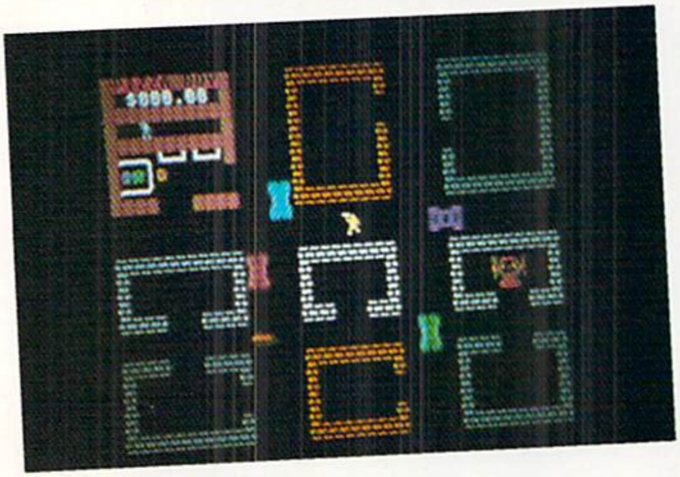




At extreme left is *Kaleidoscope,* a *DeluxePaint* image by T.J. Shank (Huntington, WV). At immediate left, from top: *Christmas Tree* by Pamela and Richard Winters (Shreveport, LA) and *Santa's List* and *Noel* by Jason Anderson (Independence, MO). Above: *Christmas Cards* by Robert M. Ellis (LaSalle, Quebec).



For the C-128
By Cleveland M. Blakemore



"Whatsa matta wit youse, ya lazy bum?! The Smiths' pizza has been unner duh heat lamps fer twenty minutes! Get it to dere house before it goes cold, or yer fired, ya greasy louse!"

You can't decide which is worse about your new job as pizza boy: your whining boss or the city that you deliver in. Between speeding motorists and rabid mongrels, it seems like your wages are ridiculously low. Worst of all, the delivery boy has to pay the difference if a pizza shows up cold.

Pizza Boy is a fun, fast action game written entirely in BASIC 7.0 for the C-128. You'll need a joystick plugged into Port 2 to play.

After the title screen, you'll be presented with a city map, in which the pizza restaurant is located in the upper left corner. The restaurant area contains a window displaying how much money you've made, a block for the three lives you start out with, and the pizza counter beneath. Your boss is the grimacing fellow behind the counter; he sits next to the telephone and takes orders.

When an order is called in, the hungry caller lights up inside the house of origin, with a ravenous look on his face as he sits before an empty plate with knife and fork.

The boss will place a pizza under the heat lamps after taking the caller's order, awaiting your pickup and delivery. To pick up a pizza, merely stand under the heat lamp, close to it, and press the fire button. The pizza will vanish, meaning you are now carrying it.

Every time a pizza is placed under the heat lamp, the pizza boy's figure will light up with a color representing the temperature of the pizza. He starts out a steaming yellow, but will cycle through light red-dark red-brown-blue-black, to indicate the temperature of the pizza as it cools.

As long as the pizza is under the heat lamp, it cools slowly. Once you have it in your possession, it will cool very rapidly, so get it to the caller as quickly as possible. A regular pizza costs $20, but the customer may tip if it is warmer than expected, and he will certainly deduct from the base price as it grows colder. How much profit you make depends on the speed with which you arrive with the caller's pizza.

As if this weren't difficult enough already, you have to dodge the automobiles in town and watch out for the mad dog as you race through the streets. Once you arrive at a customer's house, go through the door and touch him to get your money. Immediately, another caller phones in, and a pizza is sitting under the heat lamps back in the restaurant, getting frosty while you hurry back.

If you get struck by a car or bitten, you lose one pizza boy. If you allow a pizza to grow completely cold, you'll also lose a boy.

Every time you successfully deliver five pizzas, the cars will pick up the pace a little. It gets pretty tough to navigate the city after 10 pizzas. If you manage to make anything over $100 in profit, you're a natural.

Don't let anybody tell you that BASIC 7.0 cannot be used to churn out some really terrific games without machine language. All it takes is a little patience and some imagination. I'd say that *Pizza Boy* is the best 100% BASIC arcade game I've ever written. □

SEE PROGRAM LISTING ON PAGE 90

PHOTOS: MICHAEL R. DAVILA

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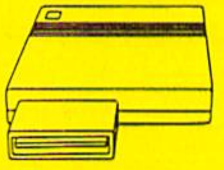
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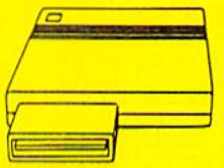


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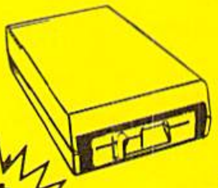
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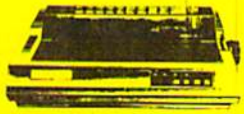
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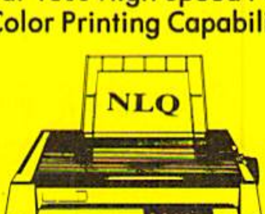
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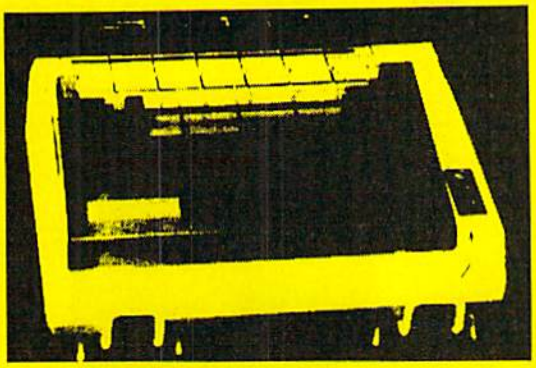
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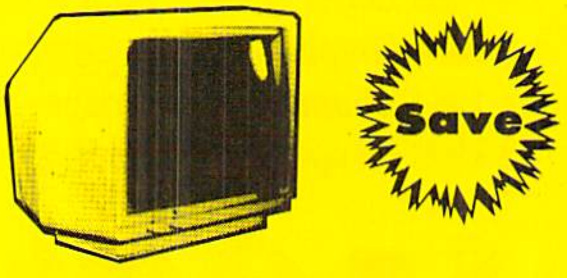
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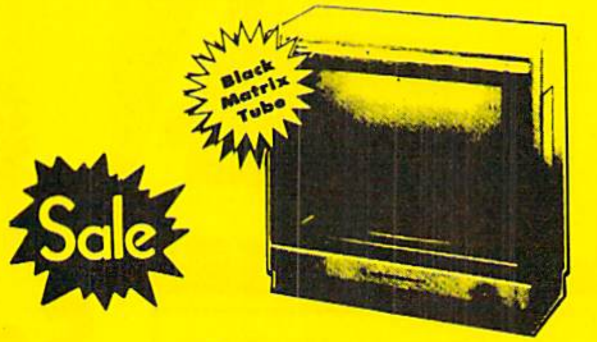


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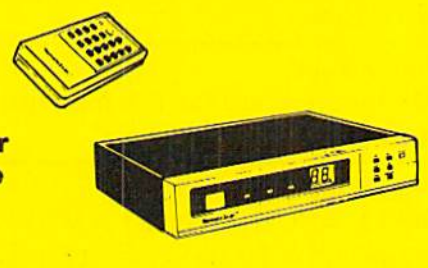
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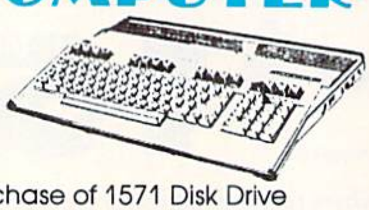
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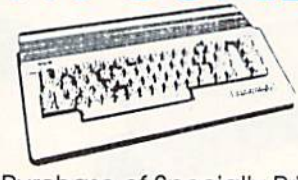
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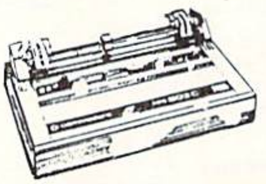
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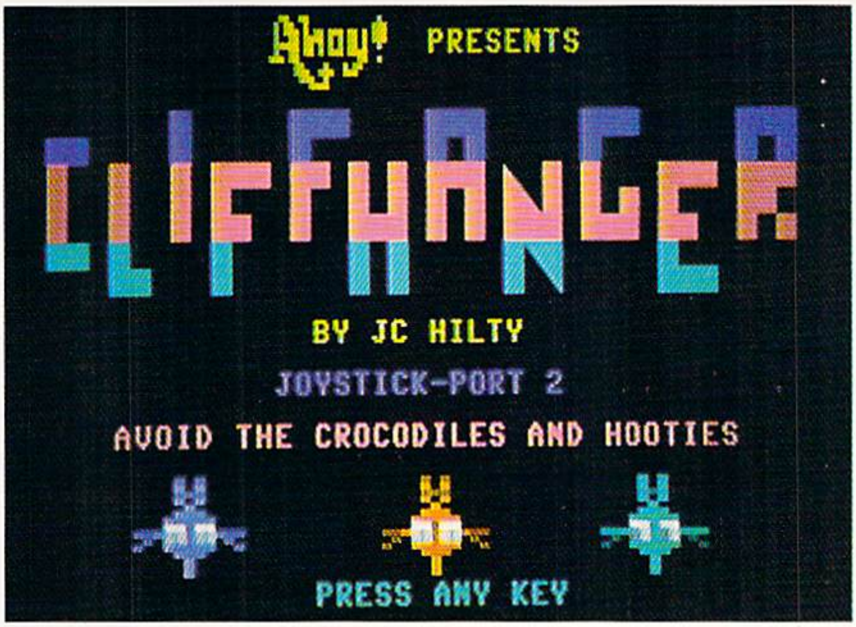
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After several grueling months in the jungle you finally reach your destination: the cliffs of Mount Gemstone. At the top of the mountain are large rubies and diamonds worth a fortune. Getting the precious stones will not be easy. Over the centuries deep crevices have formed in the mountain, making it extremely difficult to scale the cliffs. Crocodiles roam the flat areas, always in search of a meal. As if these weren't enough to worry about, strange winged creatures called Hooties hover around the mountain, ready to knock you off a ledge.

Cliffhanger is a game for the C-64 which pits your skills against those of a swarm of Hooties. Using a joystick in Port 2, it is your goal to reach the diamond at the peak of the mountain. You may move your man north, south, east, or west. Your first concern is to stay on the mountain. Falling off will cost you one of the four lives that you begin the game with. Running into one of the crocodiles will also cost you a life. If you reach the diamond you will receive the points remaining on the bonus clock which counts down from 500. If the clock reaches zero, you lose a life.

The mountain and crocodiles are dangerous, but the main threat to your mission is the Hooties. There are four of them flying around, the most dangerous of them being the light green Hootie. This creature has you homed in from the start and he moves at a different speed on each level, making him very unpredictable. All Hooties possess keen eyesight and all are capable of knocking you off a cliff with a flap of their wings.

Cliffhanger consists of three programs: the two short machine language programs, CLIFFHANGER.ML and CLIFFHANGER.SP, which must be typed in using *Flankspeed* (see page 89), and the main BASIC program, CLIFFHANGER.

CLIFFHANGER.ML and CLIFFHANGER.SP *must* be saved under those filenames. If you are using tape, change the device number in lines 902 and 904 of the BASIC program from 8 to 1, and save the programs in the following order on the cassette: CLIFFHANGER, CLIFFHANGER.ML, and CLIFFHANGER.SP. If you are using disk, be sure all three programs are on the same disk.

PHOTOS: MICHAEL R. DAVILA



To play the game, load and run "CLIFFHANGER",8 for disk or "CLIFFHANGER",1 for tape.

Cliffhanger features an animated title screen with fast-paced theme music, as well as a lot of sprite animation. The gameplay is fast, and I believe the Hooties will prove to be a worthy adversary. I hope you enjoy *Cliffhanger* and that you will return from Mount Gemstone with a wealth of precious gems. Good luck! ☐

SEE PROGRAM LISTING ON PAGE 99

RUPERT REPORT

Artificial intelligence is a hot topic these days. How is information stored in the human brain? How is that information learned and how is it accessed? Can we develop computers that duplicate or at least simulate the capabilities of the brain? These concepts are in the realm of artificial intelligence, or AI as it is called.

The areas encompassed by AI are wide-ranging, from biology to mathematics, psychology to electronics. Among the most prominent implementations of AI are so-called "expert systems." These programs incorporate to various degrees the knowledge and reasoning abilities of experts in a given field such as auto mechanics or medicine. Expert systems are basically database programs with sophisticated logical inference capabilities.

Other studies of AI attempt to model the human brain at the biological level. Electronic engineers and biologists are working to duplicate the neuron structure of the brain. Individual neurons are the logic gates of the brain, analogous to the AND and OR gates of a digital computer.

Besides modeling single neurons, several companies are working to create useful networks of them. Man-made neural networks are currently implemented in software and in silicon. Experimental work is being done to produce biological neural networks. University research projects deal with the complex theoretical aspects of neural structures.

This month we will discuss a software model which shows some capabilities of learning. The critter we will create moves around rather haphazardly, receiving inputs and responding to them. Eventually, through trial and error with some feedback, the model acquires "knowledge." Our simulations will show that, in some sense, this model is more "intelligent" than its less gifted cousins who do not have the learning ability.

The model of artificial intelligence we will create is certainly artificial. Initial experimentation with it will probably raise concerns as to whether or not it is really intelligent, however. This learning model is meant to provide a starting point for exploring AI.



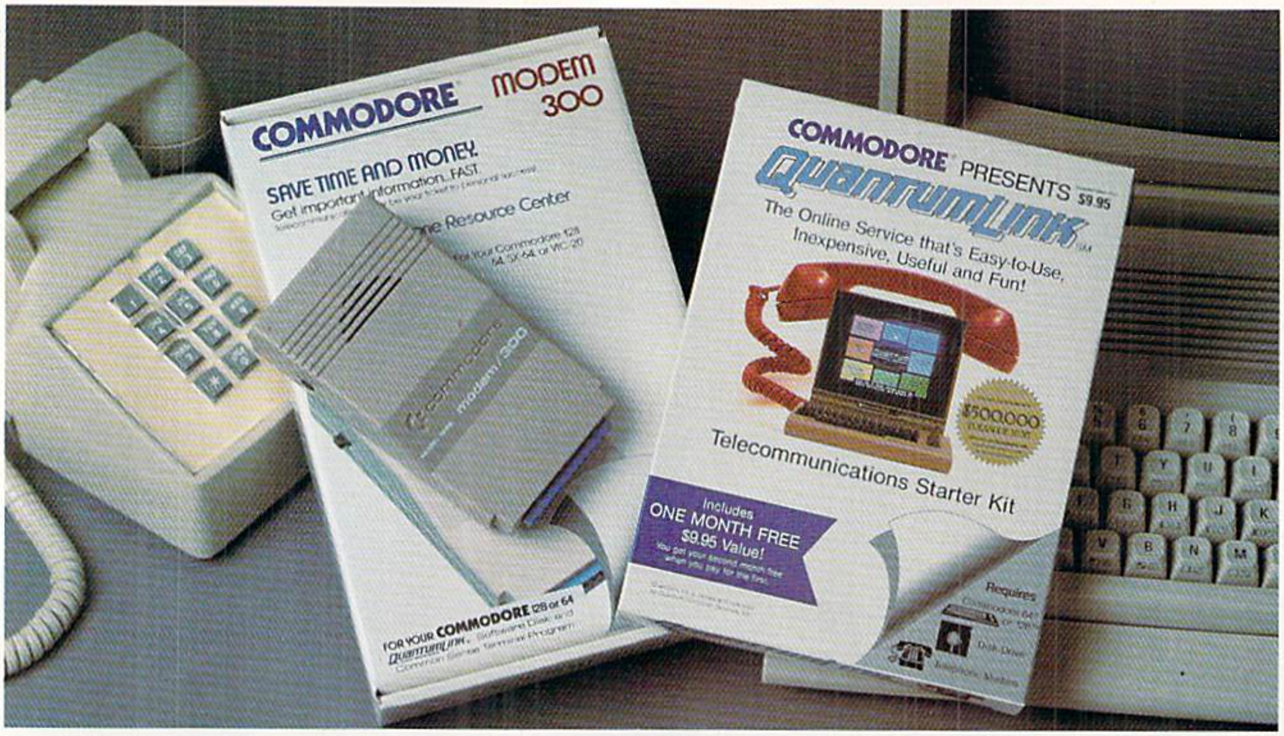
LEARNER

By Dale Rupert



HENRY BLAZER

A Model for Exploring Artificial Intelligence



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INTRODUCING LEARNER

Our learning device is called Learner. It moves around on a grid of cells. Learner has five sensors. Each sensor sees the environment of an adjacent cell in one of the directions (up, right, down, and left) with respect to Learner. A fifth sensor monitors the cell that Learner currently occupies.

Picture the grid of cells and Learner's sensors as shown in Diagram A below. The cells are either background cells or target cells. Learner's basic goal is to learn to move around the grid only on the target cells.

It would not be difficult to program Learner to remain only on target cells. A simple algorithm would be:

1. Check each sensor 1 through 4.

2. a. If a sensor is on a target cell, then move to the cell in the direction of that sensor. Else,

b. If none of the sensors are on target cells, then move randomly to another cell.

3. Repeat from step 1.

This does not really sound like a very interesting program. We are interested in the much more intriguing concept of writing a program which allows the device to "learn" to follow the target cells. Certainly the program must contain some rules governing Learner's behavior. The point of this exercise is that Learner will not move according to some fixed algorithm. Learner will develop its own mechanism for moving.

LEARNER'S DETAILS

The software structure of Learner is shown in Diagram B on page 36. The Memory Matrix is a box of numbers. The values of the sensor inputs are multiplied by those numbers and groups of those results are added together. These sums determine "weighting factors" for the four possible moves. The move with the greatest "weight" is the one Learner chooses.

Initially all moves will be equally likely. In that case, Learner picks a move (up, down, left, or right) at random. If that move lands Learner on a target cell, it is considered to be a "winning" move. The values of the sensors before the move are added to the column of the memory matrix corresponding to that move. In this way, that particular move will be more likely the next time Learner's sensors see the same surroundings.

If the move puts Learner on a non-target cell, either a background cell or a border cell, that move is called a "losing" move. The sensor values are subtracted from that move's column of numbers in the memory matrix. This should reduce the probability of Learner's making the same dumb move the next time its sensors see that particular pattern of cells.

The actual mathematics of determining the probabilities for each move are as follows. The Sensor array contains five values. Each column of the Memory Matrix contains five values. Take the first column of the Memory Matrix. The first Sensor value is multiplied by the first element of that column. The second through fifth Sensor values are each multiplied by the corresponding element in that column of the Memory Matrix. Finally the sum of those five products is put into the first element of the Move array.

This process is repeated for the other three columns of the Memory Matrix. The Move array then contains four elements. Each element is the sum of the products (called the sum-product) of the Sensor array times the corresponding column of the Memory Matrix.

A simplification of the process should clarify it. Consider a three-element Sensor array and a two column by three row Memory Matrix:

```
Sensor   Memory Matrix

  2          5    2

  3          4    5

  1          6    7

            M1   M2   Move Array
```

The two elements of the Move Array are calculated like this:

```
M1 = (2 * 5) + (3 * 4) + (1 * 6) = 28

M2 = (2 * 2) + (3 * 5) + (1 * 7) = 26
```

The first sensor sees a cell value of 2. The second and third sensors see cell values of 3 and 1 respectively. In this simplification, there are two possible moves, M1 or M2, say

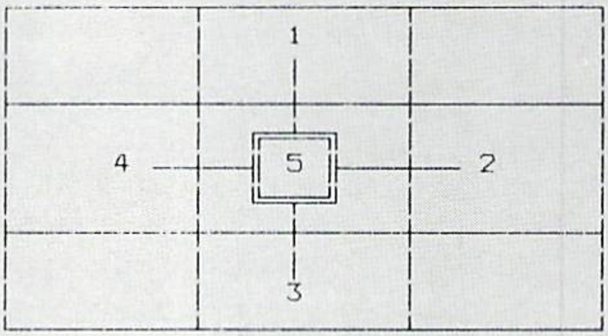


DIAGRAM A

to the left or to the right. From these results in the Move Array, Learner's next move would be to the left since M1 is the larger of the two values.

In case of equal values in the Move Array, Learner flips a coin and randomly chooses from all moves with values equal to the maximum.

Assume that the move to the left was a winning move. In that case, the values in the Sensor array are added to the corresponding elements in the first column of the Memory Matrix. As the result, the Memory Matrix now looks like this:

```
7   2

7   5

7   7
```

The first column will generate an even larger sum-product the next time that particular arrangement of sensor inputs is observed.

What if that move to the left were a losing move instead? In that case, the Sensor values are subtracted from the elements of the first Memory Matrix column. The Memory Matrix now looks like this:

```
3   2

1   5

5   7
```

You may work through the mathematics to see that, with this Memory Matrix, Learner will not move to the left the next time the Sensor inputs are 2, 3, 1:

```
M1 = 2*3 + 3*1 + 1*5 = 17

M2 = 2*2 + 3*5 + 1*7 = 26
```

Because the weight of the losing move was diminished, Learner has now "learned" not to make that move under the given circumstances.

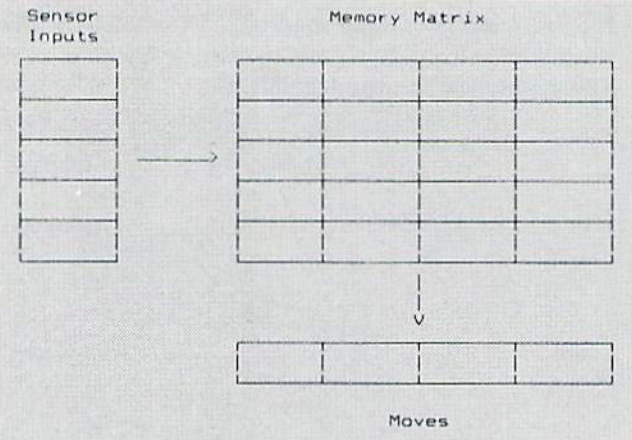


DIAGRAM B

The mathematical details of this model are much simpler than those being used today to represent actual neural networks and associative memories. This model at least gives a general feeling for the types of structures actually used. The simplicity of the mathematics makes the workings of our model more intuitive. The simple example above has just shown why this model ought to be successful, at least in some cases. It is left up to you to explore its range of capabilities and limitations.

LEARNER'S IMPLEMENTATION

The program to create the learning model just discussed is fairly lengthy; however, none of it is particularly complicated. Refer to *Learner* on page 92 for the following discussion.

The program is written in modular form, both for ease of writing and debugging, and for your ease of modifying. The arrays are dimensioned in line 10. The Sensor array SENS contains five elements. The Memory Matrix MEM is a four by five array. The four elements of the Move array are contained in PROD. The grid on which Learner moves is represented by the SCRN array.

The grid can be as large as 20 by 20 cells with a one-cell border for a 40-column display. A 10 by 10 grid is plenty large and is used in this listing. The size of the square grid is given by SZ in line 540. The values in the SCRN array are given by TG, BG, and BD, the target, background, and border values specified in line 600. These are the values seen by sensors and stored in SENS.

As written, the target cells have a value of 1. The background cells have a value of 0, and the border cells have a value of 2. The sensors will see only 0's, 1's, or 2's. You will want to experiment with different values (weights) for the various cells. Moving to a large target ("winning") cell value produces a large reward; landing on a large border ("losing") cell value will result in a large punishment.

The loop at line 550 creates the "tabula rasa" (clean slate) of the Memory Matrix. You may want to simulate some genetic influences by stuffing values other than 1 into some of the cells. In that way, Learner can be made inherently smarter or dumber than the pure soul who enters the world without any natural instincts.

Lines 580 and 590 get the screen characters to be displayed for the grid. Grid cells with a value of 0 are displayed as periods. The target grid cells having a value of 1 are displayed as "0's". The border cells are not displayed unless Learner lands on them, in which case they are "#". The background cells are defined at line 610. The border cells are given at line 660.

The X,Y values of the target cells are given in the DATA statements starting at line 650. The cells are numbered (1,1) in the upper left corner down to (10,10) in the lower right corner. The cell (3,4) is three units to the right and four units down from the upper left corner. You may change the shape of the target path by giving other pairs of coordinates. The last pair of coordinates in the list must be 0,0.

After the initialization, the grid and help menu are displayed on the screen beginning at line 800. Line 840 prints the proper screen character for each of the 10 by 10 cells. Notice that SCRN(X,Y) is either 0, 1, or 2, corresponding to either background, target, or border cells at coordinates X,Y. SC$(SCRN(X,Y)) is thereby either "." or "0" or "#" respectively.

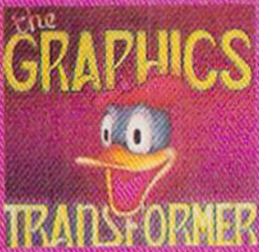
The program then enters the main operating loop starting at line 80. Flags LOSE and WIN are reset. Each pass through the main loop will determine if Learner moved to a winning cell or a losing one. The main loop consists of the sequence of subroutine calls beginning at line 90.

The first subroutine at line 1000 reads the values of the cells on all sides of Learner as well as under it. These are the screen values 0, 1, or 2 (background, target, or border) which are stored in SENS.

The GET MOVE routine at line 1100 performs the mathematics to calculate the four sum-products which will be stored in the PROD array. The routine at line 1200 searches through the four values to find the largest. The loop at line 1240 determines which elements of PROD are equal to the largest element in PROD.

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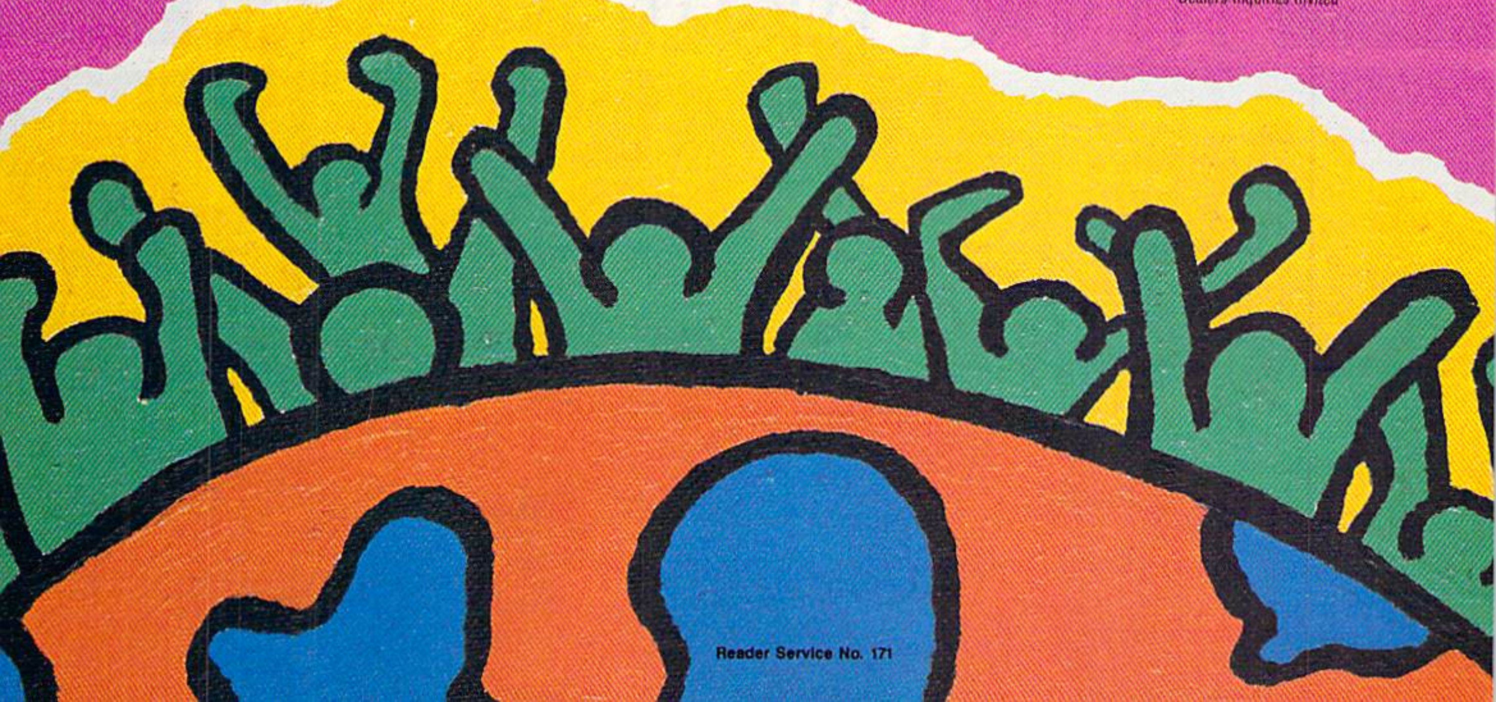
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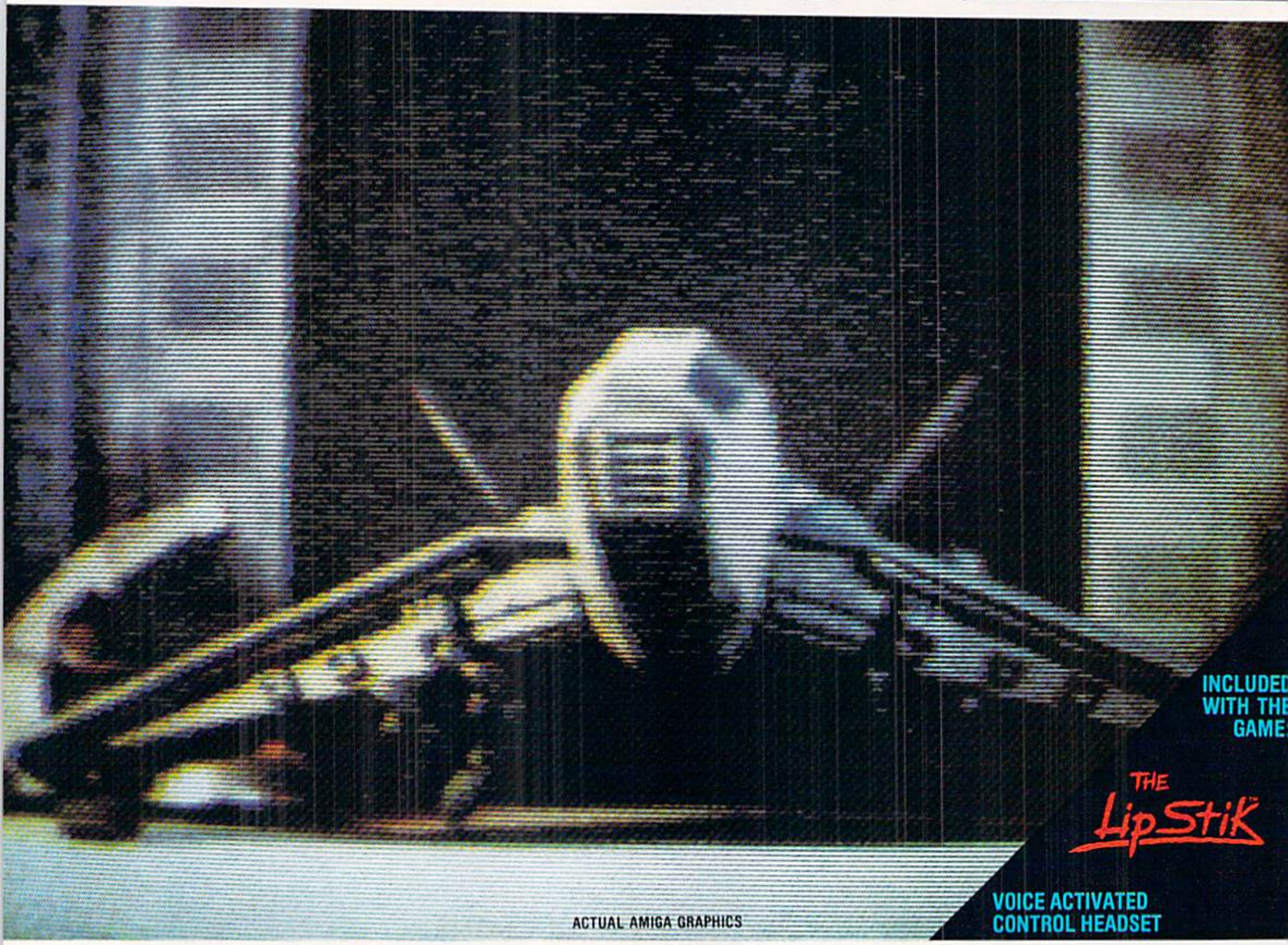
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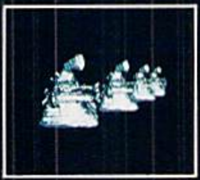
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TMP stores the subscripts of all elements equal to the maximum value. For example, if the first, third, and fourth columns had equal sum-products, then TMP(1) is 1, TMP(2) is 3, and TMP(3) is 4. This indicates that moves in directions 1, 3, and 4 are equally valid candidates from which to choose. Line 1280 randomly picks one of those moves and assigns that value to MOVE. Moves are numbered 1 through 4 as follows:

```
Moves:          1

           4         2

                3
```

Line 1300 adds an option for your experimentation. It provides the capability of occasionally picking a purely random move. The frequency of this might correspond to Learner's level of absent-mindedness or sense of adventure or whatever. As written, the random move will never be chosen since RND(0)*10 is never greater than 10. If you want Learner to move at random 30 percent of the time, change > 10 to > 7. Now the conditional statement is true roughly 3 out of 10 times.

The SHOW MEMORY subroutine at line 1900 displays the values of the SENS, MEM, and PROD arrays. It also identifies Learner's next move, based upon the elements in PROD.

There are three keyboard options monitored by the KEYBOARD routine at line 200. You may press S to begin single-step operation. Each time S is pressed, the program executes the Main Loop once, then waits for another keystroke. Pressing any key other than S returns the program to normal operation.

You may terminate normal operation by pressing the X (exit) key. This positions the cursor at the bottom of the screen and provides a cleaner exit than pressing the RUN STOP key.

The third option is to press any key besides S or X. This causes Learner to make a random move. This is a handy feature for extricating Learner from some of the repetitive sequences that it is fond of discovering. The optional random move instruction in line 1300 discussed earlier is also useful in this respect.

The MAKE MOVE routine saves the previous grid value in PREV and the coordinates in X0 and Y0. Then it calculates the new values of screen coordinates XP and YP based upon the value of MOVE selected earlier.

The INTERPRET MOVE routine at line 1500 is the place to begin your own experiments. This routine establishes the rules by which each move is judged to be a winner or a loser. As written, any move onto a target cell is considered a winner, and WIN is set to TRUE. Any move to either a background or border cell is a loser, and LOSE is set to TRUE.

You may want to treat moves to normal background cells as neutral while still penalizing moves off the grid onto the border. Replace line 1530 with this:

```
1530 IF SCRN=BD THEN LOSE=TRUE
```

That way neither WIN nor LOSE is TRUE if Learner moves to a background cell.

You might investigate the effects of sequential rules like:

```
IF PREV=BG AND SCRN=BG THEN LOSE=TRUE
```

which defines two consecutive moves without landing on a target cell as a loser.

You must always define a move onto a border cell as a loser or else Learner will wander off the screen. The computer will display error messages when it tries to plot Learner's position outside of the normal screen.

The UPDATE SCREEN routine at line 1600 restores the screen character at Learner's previous location. It draws Learner as an "X" at its new position if the current move was not a loser. If the move was a loser, the random position subroutine at line 340 is called to relocate Learner. That way when Learner moves onto a border, it gets moved back onto a proper screen grid.

If the current move is a winner, an asterisk is displayed. This makes it easier to track Learner's progress. Finally the move status and move statistics are displayed (along with a sonic fanfare on the C-128) in lines 1710 through 1740.

TEACHING LEARNER

The final subroutine is the LEARN procedure at line 1800. This is where the program decides the rewards and punishments for Learner's moves. If you remove the leading REM statement in line 1810, this subroutine is bypassed along with Learner's brain. Learner's moves will all be randomly chosen if this routine is skipped. Considering that there are 22 target cells and 118 border and background cells, the wins-to-losses ratio should be roughly 1 to 5 for purely random moves.

Any ratio significantly greater than 1 to 5 after many moves indicates that Learner has in fact learned. The LEARN routine modifies the values in MEM whenever a winning or losing move has been made. A loser causes the sensor values to be subtracted from the Memory Matrix, and a winner causes those values to be added. The value of K is −1 or 1 accordingly.

Again you can experiment with the effects of punishment only, reward only, or various degrees of reward and punishment. Set K to 0 if LOSE is TRUE in order to eliminate punishment for bad moves. Change K to decimal values less than one to "fine tune" the feedback system. Increase K beyond 1 to provide greater rewards. See how these changes affect the WIN/LOSE ratio.

You may want to limit the range of MEM values. Modify the LEARN routine to set any values greater than 10 or less than −10 to 10 and −10 respectively.

It would be possible to modify the program to analyze each move more fully. You could have the program, for instance, not only punish a wrong move, but also reward the move that should have been made.

This is not a trivial program to understand. You will find the single-step option useful after you have a general feeling for what the program is doing. The memory values and next move indicate Learner's internal state before the move is actually made on the display. That way you can see the grid values and the sum-products to know just how the move was determined.

The random move to a new cell is not considered as a winner or loser, but Learner's next move is made very quickly from the random position, and that move is evaluated.

C-64 users must slightly modify the program. The instructions begin in line 2500. The C-128's CHAR 1,X,Y command positions the cursor at line X, column Y. The C-64 implementation of this instruction is called as a subroutine at line 2700. For example, line 270 for the C-128:

```
270 CHAR 1,1,22
```

should be replaced by:

```
270 XX=1 : YY=22 : GOSUB 2700
```

A line containing a variable such as 1980:

```
1980 :CHAR 1,24,Y
```

will be:

```
1980 :XX=24 : YY=Y : GOSUB 2700
```

XX and YY must be used for the C-64.

Also, C-64 users must create their own sound routines for lines 1710 and 1720. The SOUND statements generate 10-jiffy tones of 200 Hertz and 2000 Hertz for losers and winners respectively.

The blanking character BL$ defined in line 520 for the C-64 is not as effective as the "clear to end of line" character defined for the C-128 in line 530. C-128 users must have their disk drive turned on or line 530 will cause the computer to sit and wait until it is turned on.

Using and modifying this program should be an enjoyable intellectual challenge. (That's how you learn, isn't it?) Among its more frustrating characteristics is its speed. You can slow it down with the single step S key, but speeding it up is not that easy.

You could certainly compress the program, removing *Continued on page 106*

FUELING STATION

For the C-64

By John Krutch

Deep in space, near a popular galactic crossroads, is a fueling station for spaceships. You're the operator, and your job is to manipulate incoming craft into the station, using the magnetic fields provided by four grapples.

One day, however, you find that your equipment has malfunctioned badly. The magnetic grapples are pushing spaceships in and out of the fueling station and they can't be stopped. In fact, the only control you have over the spaceships is the ability to reverse the direction of their travel. Can you simultaneously fill all four berths of the fueling station—and thus initiate the automatic fueling process—before your equipment runs out of power? Fast reflexes and fast thinking aren't the only qualities needed; you must be able to think strategically in order to position the ships in such a way that they will all occupy the station at the same time.

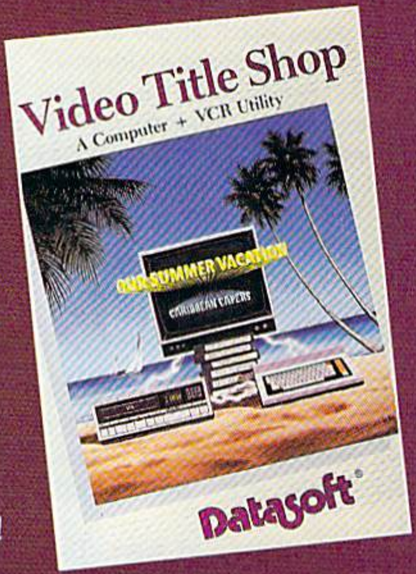
Fueling Station is a program for the C-64. You operate the program entirely from the keyboard, so no joystick is needed. You must guide four ships at a time into the fueling station. You reverse the direction of a ship by pressing one of four keys. The left-arrow key (the leftmost key on the top row) controls the leftmost spaceship on the screen. The 1 key controls the ship just to the right of the first. HOME controls the ship to the right of the second. And DEL controls the fourth and final spaceship. Only one key at a time is active.

You start out on level 1 with 150 units of energy. If you manage to guide all four ships into the fueling station at the same time before your energy is depleted, you move to the next level. Each succeeding level puts you in control of a smaller fueling station than the last, which makes it harder to guide all four ships into it simultaneously. There are four levels altogether.

Note that there are two ways to get all the ships into the station at the same time. You can depend on quick thinking and reflexes—this is most effective at levels 1 and 2. However, at level 3 and especially level 4, fast reflexes alone probably won't be enough. You'll need to think about positioning the ships in the most advantageous way.

Flankspeed (see page 89) is required to type in *Fueling Station*. To load the program, type LOAD "FILENAME",8,1 if you're loading from disk or LOAD "FILENAME",1,1 if you're loading from tape. Then type SYS 49152 to start the program. ☐ ***SEE PROGRAM LISTING ON PAGE 103***

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Reader Service No. 207

Featured This Month:

CALIFORNIA GAMES
Epyx
Commodore 64
Disk; $29.95

So, like, let the games begin, you know.

The latest entry in the fabled Epyx "Games" series, which already includes *Summer Games I, Summer Games II, Winter Games,* and *World Games,* provides the perfect counterpoint to the hard-charging, ultra-competitive milieu of the earlier contests. *California Games* lets users lay back and catch some rays while they compete in six appropriately mellow events: Half Pipe Skateboard, Foot Bag, Surfing, Skating, BMX Bike Racing, and Flying Disk.

As with previous titles in this action-strategy sports series, each event has its own theme music. The rock classic "Louie, Louie" is the overall theme song.

The graphics are also super. They capture both the intensity and superficial flakiness of the events. Lots of great little touches, like the shark that turns up after a surfing misadventure, keep the tone of the game suitably airy.

The surprising thing about *California Games* is that the best events are the ones which sound goofy, like Foot Bag (similar to "Hacky Sack") and Flying Disk (known as "Frisbee Toss" in the real world). On the other hand, the supposedly surefire contests like BMX Bike Racing and Roller Skating are mild disappointments. The simulations of these high-speed events do not communicate the thrills and sense of movement which characterize them in real life.

The two most challenging games are Surfing and Half Pipe Skateboard. The visuals on the Surfing event are spectacular, a real achievement. The user steers his surrogate surfer up and down along the inside of the "tube," foam flecking the crest of the swelling tide. The breaker advances steadily, left to right, its hungry jaws looking to swallow any hodad foolish enough to enter its path.

Half Pipe Skateboard is the "expert" game of the package. The contest takes place inside a U-shaped ramp, shown on the screen in side perspective. The skateboarder rocks from side to side to build up speed. Once in the air, the player can perform aerial turns, do hand plants at the upper ends of the ramp, and execute kick turns along the sides.



Skateboard, surf, bike, and the like.
READER SERVICE NO. 151



As you surf, the hungry breaker advances steadily from left to right.

California Games is a worthy, if somewhat offbeat, addition to the strongest action-strategy series in the history of computer entertainment. Having run out of "official" sports competitions on which to base its games, Epyx has shown great ingenuity by turning these popular pastimes into a solid leisure program.

Epyx, P.O. Box 8020, Redwood City, CA 94063 (phone: 415-366-0606).

–Bill Kunkel

SANXION
Electronic Arts
Commodore 64
Disk; $19.95

Sanxion, by the team of Stavros Fasoulas and Thalamus Ltd., is another British import which boasts plenty of action and graphics but no imagination.

"You are the lone defender of a world under siege. Hordes of alien warships rain down on the cities." Sound familiar? Believe me, so is this game. The lower two-thirds of the screen presents a *slightly* modified side perspective with left to right scrolling. The gamer can move the fighter up or down and change speed. The top third of the screen is an "early warning" display. Alas, objects appear on the overhead screen nanoseconds earlier than they do on the primary screen. It is as though the designer, intent on doing an update of the classic *Defender,* included a secondary screen because the earlier game had one!

As is the case with all too many British games, the documentation is almost non-existent. It is a flimsy little sheet that doesn't explain much of anything. The rules imply that perhaps the player should collide with some of the enemy drones, pick up certain types, and shoot others.

When the player reaches one of the ReGen stations, the program emits an onscreen training course which classifies each type of target drone. This introduces an interesting concept: The user must reach a certain level of proficiency before he may learn the rules of the game.

The visuals are decent, but nothing special. There are cityscapes and desert scenes. If the player works through all ten racks (called "World Sectors"), he is promoted to Sanxion Class 1 and is sent off to patrol the Darkside.



Sanxion: *another British* **Defender.**
READER SERVICE NO. 152

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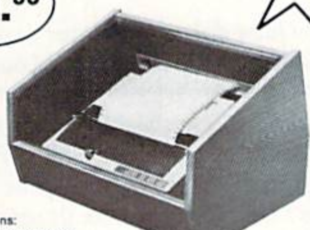
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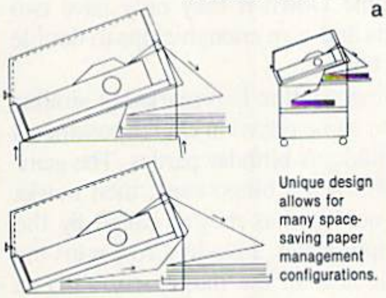
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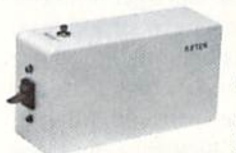
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There's nothing wrong with a good shoot-em-up, but *Sanxion* just doesn't cut it. The game is *very* hard, but without the visceral payoff one expects in such contests. The onscreen objects are too large and they move much too quickly, robbing the game of any strategic possibilities.

Sanxion is a mediocre product with some superficial glitz but nothing underneath. *Defender* is *still* a better game.

Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404 (phone: 415-571-7171). *—Bill Kunkel*

RABBITJACK'S CASINO

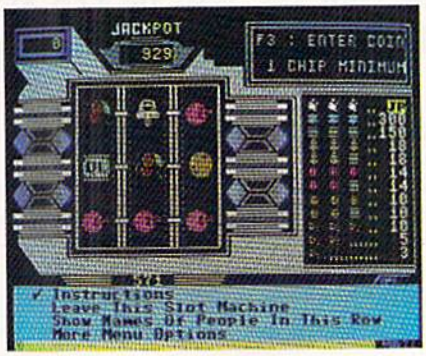
QuantumLink
Commodore 64
Disk; $7.50 to Quantum Members, $14.95 with Quantum Membership Kit

Everyone has a poker face in *RabbitJack's Casino.* You can't get a hint of the cards in your opponent's hand from his or her expression. That's because the competitors in this online casino are not sitting face to face in a smoky room. Instead, they're connected through modem, telephone, and QuantumLink's telecommunication service.

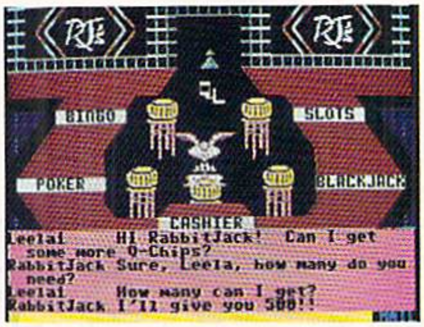
RabbitJack's Casino Games lets Q-Linkers compete head-to-head with Vegas-style games. Five-Card Stud Poker, Blackjack, Slot Machines, and Bingo pit computerists against one another and against the house odds. In some ways, this casino has it all up on its Vegas and Atlantic City counterparts. RabbitJack first provides players with the points to wager; that's something Jimmy the Greek will never do for you! It's also a whole lot less painful to lose in *RabbitJack's Casino.* Even if your luck goes bad and you lose all your points, this happy hopper will give you a new stake to start again the next day!

QuantumLink members sign onto the telecommunications network in the normal way, go into People Connection (the section of QuantumLink for conversing with other Linkers), select Game Play from the menu of activities, and insert the Games Disk. When the computerist selects *RabbitJack's Casino Games* from the menu, the Linker is ushered into the Casino Lounge.

The bunny himself is on hand in the Lounge to get the gamer started. Here



RabbitJack's *slots: not the best bet.*
READER SERVICE NO. 153



RabbitJack doles out lettuce and online assistance in the Casino Lounge.

the gambler checks high scores for each contest, including a Hall of Fame vanity board, chats with anyone else in the Lounge at the time, or searches out the location of other Linkers. While in the Lounge, the gamer can send online messages and electronic mail to other Linkers. A player piano in the Lounge provides rousing ragtime to add a little audio excitement.

Coin is easy to come by in this electronic gambling den. Visitors receive a daily ration of 250 points, added to their account the first time they enter the Lounge each day. Players also gain (or lose) points gambling. Indigent Linkers can even cozen other gamers to transfer points to their account, so opportunities for interaction between point-greedy gamblers can be lively.

To move from the Lounge into the game rooms, the gamer manipulates RabbitJack with the F3 key, hopping him on one of four bar stools labeled Bingo, BlackJack, Poker, or Slots.

In each game, either the player chooses the specific table he wants to join (in order to play with a group of friends, for example) or the computer will randomly assign the Linker to a table.

The star game of the Casino is undoubtedly Five-Card Stud Poker, where up to five humans compete against one another. Each is dealt a hole card, then four cards face up, one at a time. A bet-placing period follows each card dealt. Players can bet, call, raise, check, or fold. All players' face-up cards are visible, but each hole card is only seen by its owner.

Across the bottom of the screen is a chat window which is visible during gameplay for all four entertainments. Here the players type their remarks to one another. As in real life gambling, some players are tight-lipped, with little to say that might reveal their betting strategies, but most Linkers love to chatter with each other while they play. Bluffing is definitely part of the contest. And the competition can get keen in a group of avid card sharks, as they goad each other throughout the game.

Blackjack is played just like casino-style 21, by up to five Linkers. Hole cards are hidden from view, but other cards are visible to all players at the gaming table. The computer dealer must take a hit if his first two cards total 16 or less, and will stand on a total of 17 or more. The hand with the highest point total up to 21 wins. If the card total is equal to the dealer's, the player keeps the chips that were wagered; Blackjack doubles the chips that were bet. Gamers also have the option to Double Down if they only have two cards and own enough chips to double the bet.

Bingo online is remarkably similar to the game played in church basements or children's birthday parties. The gamer chooses a bingo card, then marks the numbers as they're called by the compu-dealer. Five in a row wins the game and all the money currently in the pot. Simultaneous winners split the pot. The gamer's card and a board of all numbers called so far dominate the screen, and other players' cards are, of course, not visible.

RabbitJack's Slot Machines are the only real disappointments in the Casino. An onscreen slot machine fills the screen, and the gamer chooses which rows, one, two, or three, to play. The reels spin with a press of F4, and the winning combinations and payouts are displayed to the right of the machine.

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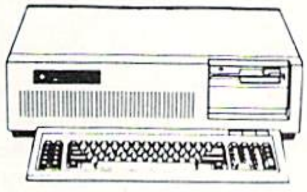
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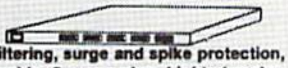
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Unfortunately, although the game is exactly similar in its essentials to the one-armed bandits that inspired it, the absence of the electronic accoutrements (bells, blinks, and brassy beauty) makes online slot machines seem very plain. Even winning a jackpot lacks thrills when there are no clattering coins banging into the cash catcher.

But neither slots nor bingo are really the stars in *RabbitJack's Casino.* Blackjack and, most especially, Poker are the games that keep Linkers going back for more. The conversational interplay between gamers, the human competition, and above all, the betting and bluffing, turn the casino into a spectacular entertainment.

RabbitJack's Casino is only available to QuantumLink members, for online play via modem, telephone, and the QuantumLink telecommunications service. It costs gamers the regular online service charge, six cents per minute. Although the points they win are not exchangeable for any tangible gain (that would violate current laws), any losses are equally intangible.

RabbitJack's Casino, designed by Rob *(Demon Attack, Missile Command)* Fulop, is a sound entertainment for fans of casino-style games. But it goes beyond that for Five-Card Stud players, where it could easily become an electronic necessity of life! Poker enthusiasts have nothing similar available to them, which makes this a must-have gaming experience for anyone who craves interactive gambling on their Commodore.

Quantum Computer Services, 8620 Westwood Center Drive, Vienna, VA 22180 (phone: 703-448-8700).

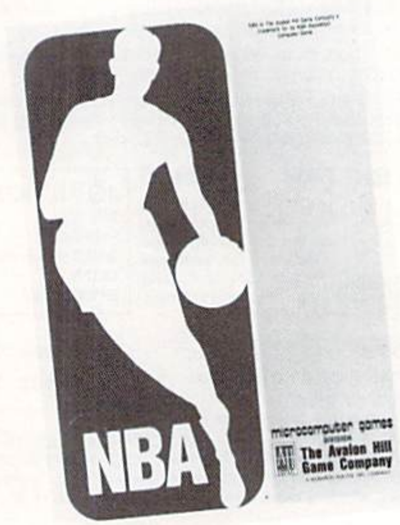
—Joyce Worley

NBA
Avalon Hill
Commodore 64
Disk; $39.95

Roundball mavens will be delighted to hear that the folks who created *Pure-Stat Baseball* and *Super Bowl Sunday* have turned their attention to the world of hardwood floors and high-top sneakers. *NBA,* designed by Software Simulations (formerly Quest), tackles the formidable task of simulating pro basketball with visual representations of all the action.

The game's format will be familiar to anyone who has played the earlier Quest sports simulations. The coach (or coaches, in a head-to-head contest), picks play strategies from onscreen menus. When both teams have their orders, an action screen shows the developing play in two-thirds perspective. Baseball and football lent themselves perfectly to this format. The back-and-forth nature of basketball makes it much tougher for the computerist on the sidelines to intervene in a meaningful way.

The game comes with 20 great teams. The selection contains a nice mix of old and new rosters, with an emphasis on more contemporary squads, including the top four teams from the 1985-86 season, the Celtics, Bucks, Rockets, and Lakers.



NBA: ***demanding for casual hoop fans.***
READER SERVICE NO. 155

NBA can be played solitaire against the computer or with another human coach. Users can give either side home court advantage, or play the game at a neutral site.

After these preliminaries, the player assembles a starting lineup of two forwards, two guards, and a center. Next to each player's name is listed his position and defensive rating, FGA (field goals attempted), FGM (field goals made), FG% (shooting percentage), ASST (assists), and 3PT (three-point play rating).

The coach of the team with the ball then picks the point guard to start the offensive play and determines whether he will shoot, pass, or kill the clock. The offensive team may make up to two passes before one of the players must shoot.

If the user elects to shoot, the program offers a choice of an outside shot, a drive-and-shoot, or a 3-point attempt. He must also determine, should the shot miss, whether his team should take the ball back out, put it back up, rebound aggressively, or guard against a fast break by the opposition.

If a pass is ordered, the coach simply enters the number of the player who will catch the ball. "Killing the clock" subtracts 24 seconds from the game clock. The coach then picks a shooting strategy.

On defense, the user can select up to two of the following strategies: guard against outside shot; guard against layup; try for steal/block shot; play for fast break on rebound; double-team player.

The statistical basis of *NBA* is faultless. In fact, the excellent documentation includes detailed descriptions of how all results are determined, and Ed Daniels of Software Simulations claims that his program is "the most statistically accurate of any of our sports simulations." *NBA* also includes its own statkeeper capability.

The graphics are acceptable, but the action is occasionally a little tough to follow. The audio, on the other hand, is strictly minor league. A shame, since a bit of sound, like the swish of a basket or the roar of the crowd, would have enlivened this simulation.

If there's a problem with *NBA,* it is that the long pauses during which coaches enter strategies distorts the "feel" of what should be a nonstop athletic event. The user spends a lot of time entering strategies, then sees the visual result flash by like Michael Jordan on a fast break. This makes for herky-jerky, stop-and-go play.

The strategic challenge and statistical accuracy, however, should more than compensate for any imperfections. *NBA* may prove a little demanding for casual hoop fans, but serious students of Dr. Naismith's game should prepare for a real treat.

Avalon Hill, 4517 Harford Rd., Baltimore, MD 21214 (phone: 301-254-9200). *—Bill Kunkel and Arnie Katz*

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(IBM screen shown. Actual screens may vary.)



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Reader Service No. 148



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Reader Service No. 161

TAKE TWO

For the C-64

By Buck Childress

Have you ever accidentally pressed SHIFT and CLR/HOME at a critical time—like when the screen is full of keyboard graphics or important program lines you've been meticulously slaving over? Maybe you inadvertently inserted a blank line which in turn pushed the bottom line into oblivion. Then there's the ol' scroll at the bottom of the screen that bumps the top line into the Twilight Zone. In any case, your work of art is temporarily, if not permanently, kaput. Don't give up and say you're through. Relax and take two, with *Take Two.*

Take Two restores your screen to its predefunct state in a flash. All characters and their respective colors reappear as if nothing ever happened. Here's how to use it.

After saving a copy of *Take Two*, run it. The loader POKEs the machine language data into memory and checks for errors. You activate *Take Two* by typing SYS 49152 and pressing RETURN. RUN STOP/RESTORE deactivates *Take Two.* SYS 49152 reactivates it.

To get the feel of *Take Two,* print or list something on the screen. Now press SHIFT and CLR/HOME to erase everything. If these were graphics it'd be hair pulling time, right?! Wrong! Just press the COMMODORE and F7 keys at the same time. Presto...Act Two, Scene Two, *Take Two.* Your work is restored.

Now cursor down to the bottom of the screen. When you get there, cursor down once more so the top line makes like a tumbleweed and scrolls away. Press COMMODORE/F7 and the top line is resurrected.

Cursor down to the bottom again and type four or five letters. They can be anything for our little demo. Now cursor up one line, then press and hold the space bar. When the cursor passes the end of the line your 64 will automatically insert a blank line and the letters you typed will go down like the Titanic. Press COMMODORE/F7 and there they are.

The important thing to remember when using *Take Two* is, don't panic! If you accidentally clear the screen or scroll a line into Never Never Land, just press the magic keys and get your second chance. The cursor always returns to the home (upper left) position...a nice, safe place after a near calamity.

Next time you glitch your screen, don't take a powder. *Take Two!* ☐ *SEE PROGRAM LISTING ON PAGE 97*

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The C128 Helper is machine language driven for speed. It works in the C128's 80 column mode with an RGB or composite monitor. You can use either a 1571 or, with slightly slower response time, a 1541 drive.

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But perhaps the single most exciting feature is this: the program is user definable. Not only can you modify the C128 Helper itself, but you can actually edit and create your own custom files! The program guides you with prompts, helping you to easily construct your own custom applications, complete with menus! You could make your own memo pads, calendars, electronic helpers for other programs—the list is endless!

But even if you only use the C128 Helper itself, you'll be getting more than your money's worth. Get your copy today!

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AMIGA SECTION

Featured This Month:

GUILD OF THIEVES

Firebird Licensees
Amiga (512K)
Disk; $44.95

The imaginary nation of Kerovnia, the backdrop for 1986's award-winning *The Pawn* (Firebird), serves as the setting for an entirely new set of exploits in *Guild of Thieves.* While the newer release is not a sequel in the strict sense of the term, it is presented in the same style and employs a system which barely varies from the one used in *The Pawn.*

This time, the player assumes the identity of a lowly student in the infamous Worshipful and Partially Honorable Guild of Professional Nocturnal and Surreptitious Entry and Removal Operatives of Kerovnia Thieves. This dreaded organization, possibly in league with the nation's locksmiths and safe manufacturers, trains the felons of tomorrow and generally represents the vested interests of Kerovnia's criminal element. Learning the principles of pilfering in a sterile classroom environment is an important part of the novice thief's training, but there is no substitute for actual "hands on" experience. The teachers have decided that it is time to see if the hero of *Guild of Thieves* has enough of the "wrong stuff" to become a major league lawbreaker.

The game begins when a master ferries the player's character to the outskirts of an unsuspecting town which the Guild judges as ripe for picking. The novice must stage a solo raid to show how well he has learned his lessons. A successful raid allows the character to join Kerovnia's Guild of Thieves.

This plot is a distant cousin of the "gilded hole" dungeons which dominated computer adventuring in the 1978-1981 period. Most previous attempts to inject a freewheeling "scoop up the loot" ambience into today's more sophisticated games have failed. It is hard to reconcile the protagonist's seemingly unbridled materialism with the heroic tradition. Casting the main character as an apprentice thief eliminates the problem. Computerists familiar with the innumerable fantasy novels about lovable rogues should have little trouble identifying with the main character in *Guild of Thieves.* There's nothing especially original about the story, but it is well constructed and enjoyable to play.

The design team wisely decided to keep the tone very light. All the stealing and cheating might become depressing if the computerist had to take it all seriously.

Magnetic Scrolls pulled out all the stops to make the instruction booklet as wild and wacky as possible. Unfortunately, the jokes are overly obvious. The 40-page instruction manual tries to simulate a popular magazine for Kerovnian thieves, but the angle of the humor is inconsistent. Typos and missing lines don't help the overall presentation either.

The rules, including a set of coded hints to aid the frustrated are embedded in the magazine. The explanation of the parser and other features is excellent and thorough. Numerous examples help even first-time adventurers get right into the action.

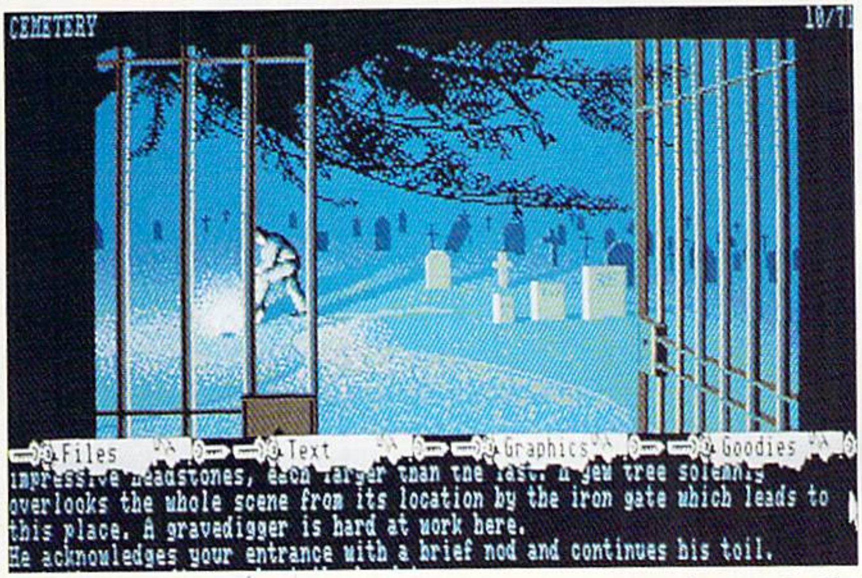
Guild of Thieves is basically a text adventure. The parser interprets the computerist's typed commands and responds with a block of text and, sometimes, a beautiful illustration. The parser, essentially the same as the one in *The Pawn,* understands more words and contexts than any rival system.

The artwork is much more detailed than in older illustrated adventures, though every location doesn't have a picture. The pull-down "graphics" menu gives the gamer a choice of three display modes: freehand, stipple, and dither. Clicking the desired choice facilitates switching among the alternatives.

Heavier use of the editorial blue pencil would have improved the text. The writing is detailed and not too flowery, but the descriptions are sometimes ambiguous. Fortunately, the parser's large vocabulary enables the player to circumvent any vague spots in the narrative.

At a time when action-adventures are pushing text quests out of the market, *Guild of Thieves* successfully bucks the trend. It unflinchingly addresses, and overcomes, most of the drawbacks of parser-driven games. This fantasy romp should provide many hours of stimulating adventuring for Amiga owners.

Firebird Licensees, Inc., P.O. Box 49, Ramsey, NJ 07446 (phone: 201-444-5700). *—Joyce Worley and Arnie Katz*



Though basically a text game, Guild of Thieves *boasts much more detailed artwork than older illustrated adventures.* *READER SERVICE NO. 174*

512K RAM EXPANDER
MicroBotics, Inc.
Amiga 500
Price: $159.00

Your new Amiga 500 came stocked with half a megabyte of RAM. That's twice as much as the 1000 originally had. Of course everyone I know dropped a RAM expander into their 1000 to boost it from 256K to 512K. And a bunch of other RAM expanders are available to take the 1000 into the megabyte and beyond range.

Just as the 1000's 256K was not enough for many users yesterday, the Amiga 500's 512K will not be enough today. And, like the 1000, the 500 is designed so that doubling its RAM is child's play. Your 500 manual describes Commodore's A501 memory and clock expansion cartridge. For my money, there's a better alternative.

MicroBotics formally calls its Amiga 500 RAM expander the "M5501 Memory and Clock/Calendar Expansion Unit." They describe their expander as "identically compatible in every feature with the Commodore unit designed for the same purpose."

An external look at Commodore's expander and MicroBotics' shows two metal cases, MicroBotics' being an inch shorter. Not much to see.

Inside the two units is where we find the similarities—and the differences. Each board has 16 256K dynamic RAM chips, an even larger number of capacitors, a ni-cad battery, a clock chip, and a handful of resistors and other components. The smaller size of the MicroBotics board is simply a function of placing the various components closer to one another.

(Remember that the size of dynamic RAM chips is measured in bits, not in 8-bit bytes. A 256K chip stores 256K bits, so it takes 8 of these chips to add 256K bytes to your computer.)

After the density of the components, the next thing that jumps out at you is the speed of the RAM chips. The Commodore unit uses 150 nanosecond (ns) chips, while MicroBotics uses 120ns. The 120ns chips are capable of operating about 20 percent faster.

Does this mean that the MicroBotics unit will run faster? Not really. The speed of your computer is controlled by other components. RAM just has to be fast enough to keep up. But I certainly wouldn't complain about having the faster, more expensive RAM on the MicroBotics board. At today's mail order prices, that's $55 to $60 worth of RAM chips.

Why all the capacitors on this (or any other) board? Technically, they are decoupling or bypass capacitors. Two principles of board design demand them. First, it is considered good practice to use a decoupling capacitor between the power and ground pins of a chip, no more than an inch or two from the chip's power supply pin. Too few decoupling capacitors and a board may work erratically. A second, related principle requires that a capacitor be placed between the power supply and ground close to every second TTL (transistor-transistor logic) chip. Whenever one of the logic gates in a TTL

switches, it will draw a burst of current capable of disrupting neighboring chips.

If you disassembled the two units from Commodore and MicroBotics, you'd also notice that the metal cases were slightly different. The MicroBotics case is heavier gauge metal and snaps together. The thinner Commodore case is soldered top to bottom. That's a mild pain for a reviewer. It is potentially more of a pain for you.

The clock in both these units relies on an internal power source, a ni-cad battery to keep the time and date when your Amiga is turned off or even unplugged. A ni-cad battery has a long life, but can't last forever. Eventually you will have to change it. With MicroBotics' snap-open case, you'll find opening the case to be no more difficult than popping out the battery once you're inside.

The thicker case of the MicroBotics did not fit into my 500 as closely as the Commodore unit. So when I snapped the plastic access cover back on the bottom of the Amiga, the MicroBotics unit bowed it out slightly. The cover fastened securely, however.

I bought one of the first Amiga 500's I could get my hands on. Long ago I gave up any delusion that I had enough will power to resist buying as much RAM as a computer would hold. Knowing that Commodore had a RAM expander to take the 500 to a meg, I just assumed I'd buy it. I hadn't even heard of the MicroBotics unit.

But when I bought my 500, I couldn't find a Commodore RAM expander. One dealer offered me the MicroBotics for less than the Commodore would cost when it became available. Was I suspicious. Not yet having ripped both units apart, all I knew was that MicroBotics somehow managed to be cheaper and quicker to market.

MicroBotics' explanation is simple and humble. As developers, they had received a 500 early on. They knew that you can't have too much RAM and chose their first product for the 500 accordingly. And they did not experience the "delays" that Commodore must have.

Installing a 512K expander (whether it's MicroBotics' or Commodore's) in your Amiga 500 is pure simplicity; no tools required. Just disconnect the cables, turn the 500 over, pop open the plastic access panel, set the RAM expander into the slot, and slide it toward and onto the pins protruding from one end of the slot. Pop the plastic cover back on, reconnect the cables, and 1 meg is yours. After the installation, you may want to leave your Amiga powered up for several hours to put a good charge on the ni-cad battery.

With the new Workbench 1.2, your Amiga will automatically recognize the new RAM. Startup-Sequence grabs a few K here and there so you'll have about 905K free memory with your new MicroBotics RAM expander. Without it, you'd have only 393K free. At the top of the Workbench screen is the Amiga's "memory meter" which will show free memory unless you're working in a window. (Since 1K equals 1024 bytes, 905K will show up as over 926,000 bytes of free memory on the meter.)

My 500's Workbench 1.2 disk automatically creates a 10K buffer for the disk drive (a little RAM area to speed up disk access) and opens a RAM disk complete with Workbench disk icon. Actually, it's the command "Dir RAM:" in the file Startup-Sequence in the S subdirectory that opens the RAM disk.

The Amiga's RAM disk gives you the best of both worlds—speed and flexibility. A RAM disk, by definition, uses some of your precious RAM to simulate a disk drive for quick access. On most computers, you must define the size of your RAM disk and reboot to increase or decrease that size. Amiga's RAM disk is dynamic. It starts out using only 1K, then grows as you copy programs or files to it and shrinks whenever you delete one of those files. (Try the INFO command to check this out.)

RAM disks are a good reason to drop a MicroBotics unit into your 500, especially if you're running with a single floppy drive. If you want access to all the Amiga DOS goodies, like CD Copy, Dir, List, Rename, Why, Delete, EndCLI, and Type, you can edit Startup-Sequence to copy all those files to the C subdirectory of the RAM disk. Then use an "Assign C: RAM:C:" to tell the Amiga to find them there and quit bugging you to "Please replace Workbench 1.2 in any drive" every time you need a DOS command.

If you try this trick with a stock 512K

Amiga (and copy all the C subdirectory files), you will have less than 215K free. With a MicroBotics unit, you'll still have over 720K left.

One of the nicest things about MicroBotics' unit isn't the RAM at all, but how well it works with the new Workbench 1.2 that comes with your 500. Amiga has always had a very conservative approach to memory management. Under older Workbenches a memory management error, like an application program using a portion of RAM that it shouldn't, was enough to cause the Amiga to reset after a "software failure." Or, if the system ran out of memory, it was liable to crash.

But the new Workbench 1.2 seems to be pretty solid with the MicroBotics unit. Not only is all your extra RAM automatically recognized, but even running out of RAM does not seem to be a problem. All I could get was a mild-mannered "Ran out of memory. Please free some and try again" message.

Another nice feature is the clock/calendar (which works just like the Commodore expander's). To set the clock, you issue the "SetClock opt save" command from the CLI after having entered the date and time. Then put the "SetClock opt load" command in Startup-Sequence and your Amiga will boot up with the correct time and date. Timestamping your files, so you can tell one version from another, is nothing to sneeze at either.

Of course the best thing about 1 meg of RAM is...1 meg of RAM. Unless you limit yourself to playing 512K games and producing small- to medium-size documents with a word processor, that RAM will be a real benefit. *VIP Professional*, for instance, is a great spreadsheet, but it leaves only 36K for data on a 512K Amiga. With the MicroBotics expander, you will have over 560K, enough room to build a proper spreadsheet.

Like spreadsheets, many database programs can make good use of additional RAM. And, naturally, graphics programs love the stuff. Hi-res graphics use enough RAM to make you wish your 500 would hold two MicroBotics boards.

Finally, if you're a bit adventuresome, all that RAM will come in handy for multiprocessing. That's running two or more programs (executing two or more processes) at the same time. The Amiga can assign each of several processes its own priority and, since the 68000 CPU can handle only one at a time, juggle the various processes with each one running according to its priority.

An easy way to see this is to open three CLI windows (with the NewCLI command) and arrange them so they do not overlap. Then run an application in each one. Or select several of the graphics demos from the Workbench 1.2 demo drawer at once. As you add each one, you'll see the speed of the individual demos degrade.

Your Amiga does a lot of multiprocessing behind the scenes. Change a disk while a program is running and the Amiga will log in the new disk without your ever being aware, unless you notice the green light or disk sound. But this well-mannered computer will wait until your application is "resting"; it won't interrupt.

(Exec is the set of Amiga routines that is responsible for managing lists of tasks, switching tasks, posting messages between tasks, allocating memory, etc. For a good discussion of multiprocessing, try Robert Peck's *Programmer's Guide To the Amiga* from Sybex.)

So, you've got your new Amiga 500, a nice monitor, and a fistful of software. What's your next purchase? I recommend the MicroBotics M5501. The extra RAM is great whether for programs or as a RAM disk, the clock is handy, the warranty is 120 days (⅓ longer than Commodore's), and the price (about 20 percent less than Commodore's) is definitely right.

MicroBotics, Inc., 811 Alpha Drive, Suite 335, Richardson, TX 75081 (phone: 214-437-5330).

–Richard Herring

Coming Amiga Reviews

- **Digi-Paint**
- **Compu Save 20 Meg Hard Drive**
- **VizaWrite**

And—Best Amiga Games of 1987

THE INS AND OUTS OF THE C-64/128 EXPANSION PORT

Some Hard Facets and Soft Aspects to This Bidirectional Gateway to the Heart of the Machine

By Morton Kevelson

The unique aspect of the personal computer as a home appliance is its lack of a specific application. While all other home appliances are rigidly designed to serve but a single purpose, the personal computer is characterized by its flexibility, which enables it to perform a multitude of diverse tasks. All that is required to change the machine's mission is simply to have it read off a new set of instructions from a storage medium such as a floppy disk. The C-64 and the C-128 have been designed to be flexible in hardware as well as in software. The 44-pin expansion port which is built into these machines permits the installation of a wide range of powerful hardware options that greatly expand the capabilities of the computer. A small sampling of the available products may be seen in the *Reviews* sections of this month's and last month's *Ahoy!*

We now present a detailed description of the hardware aspects of the expansion port on the C-64 and the C-128. Software hackers take note. You will find this information to be invaluable, as it will lead to a better understanding of the workings of your favorite computer by adding meaning to some of the cryptic PEEKs and POKEs you have to deal with.

The physical arrangement of the expansion port is a 44-pin edge card connector. The contacts are arranged in parallel rows of 22 each with their centers spaced one tenth of an inch apart. If you look into the port from the back of the computer, the top row of contacts is numbered from 1 to 22 going right to left. The bottom row is numbered A to Z, also from right to left. Because there are only 22 contacts on each row, the letters G, I, O, and Q are not used. In view of the close spacing and the presence of normal operating voltages on these contacts, it is a good idea not to insert anything in or remove anything from this port while the power is on.

We will now present a pin by pin description of each contact and the purpose it serves in the C-64 and C-128 scheme of things. Note that the port is superficially identical in both the C-64 and C-128 computers. In fact it is designed to function identically when the C-128 is in C-64 mode. There are some internal differences which we will point out as we go along.

We will deal with the contacts in the order of their complexity. Contact numbers 1, 22, A, and Z are tied to the system ground. In electrical terms ground represents the point to which all voltages are referenced. The measurement of voltage, or electrical potential, is always done with reference to a point of known potential. In the case of the C-64/128 and most other computers, all voltages associated with the operation of the logic circuitry will be either at

PLA MEMORY CONFIGURATIONS IN THE C-64

Config #	Control Bits: CHAREN	HIRAM	LORAM	EXROM	GAME	Contents of Memory: $8000–$A000	$A000–$C000	$C000–$D000	$D000–$E000	$E000–$FFFF
1	1	1	1	1	1	RAM	BASIC	RAM	I/O	KERNAL
2	0	1	1	1	1	RAM	BASIC	RAM	CHAR	KERNAL
3	1	1	0	X	1	RAM	RAM	RAM	I/O	KERNAL
4	0	1	0	X	1	RAM	RAM	RAM	CHAR	KERNAL
5	1	0	1	X	1	RAM	RAM	RAM	I/O	RAM
6	0	0	1	X	1	RAM	RAM	RAM	CHAR	RAM
7	X	0	0	X	1	RAM	RAM	RAM	RAM	RAM
8	1	1	1	0	1	CART.	BASIC	RAM	I/O	KERNAL
9	0	1	1	0	1	CART.	BASIC	RAM	CHAR	KERNAL
10	1	1	1	0	0	CART.	CART.	RAM	I/O	KERNAL
11	0	1	1	0	0	CART.	CART.	RAM	CHAR	KERNAL
12	1	1	0	0	0	RAM	CART.	RAM	I/O	KERNAL
13	0	1	0	0	0	RAM	CART.	RAM	CHAR	KERNAL
14	X	0	1	0	0	RAM	RAM	RAM	I/O	RAM
15	X	0	0	0	0	RAM	RAM	RAM	RAM	RAM
16	X	X	X	1	0	CART.	NOT-USED		I/O	CART.

ground potential (zero volts or logical zero) or at five volts (logical one) with respect to ground.

If you wish to observe the voltages on the expansion port, one lead of your test instrument should be connected to the system ground. A simple voltmeter will not be adequate to observe most voltages on the expansion port. With the exception of the power supply voltage, all of the logic signals are continuously and rapidly changing in response to the demands of the system. An oscilloscope may be used to observe the voltage on a single contact.

A multiple channel digital storage oscilloscope would be required to properly monitor the status of several signals at the expansion port. This type of instrument has the ability to simultaneously display several channels at once in real time. In digital logic circuits the value of groups of signals at a particular instant is of importance; for example, all eight signals which form the data bus or all sixteen signals which represent the 6510's address bus.

Contact numbers 2 and 3 are connected to the system's 5 volt power supply. A small amount of current (less than a quarter of an Ampere) is available at these contacts to power peripherals connected to the expansion port. The actual available current depends on what is used by other peripherals which may be connected to the computer's user port, joystick port, and cassette port, as these each have a contact to the 5 volt supply as well. Note that peripherals connected to the serial port do not impose a load on the computer's 5 volt power supply, as they are self-powered. The exception may be a printer interface equipped with a separate lead to the 5 volt contact in the cassette port or to one of the joystick ports.

The limitation on the amount of current which may be drawn from the 5 volt contact in the expansion port is due to the minimal capacity of the C-64's power supply. The C-128, which has a heavier duty supply, can deliver additional current to expansion port peripherals. It is possible to obtain greater currents from the C-64's expansion port by upgrading the power supply. Commodore actually provides the equivalent of a C-128 power supply when you buy their 256K memory expansion module, the 1764.

Keep in mind that although the power supply may be upgraded, the printed circuit traces to the expansion port will remain the same size. These will be the ultimate limitation on the amount of current which can be delivered via this port. Expansion port peripherals which require large amounts of power supply currents should have their own 5 volt source. In this case the external 5 volt line should be isolated from the C-64's built in 5 volt supply. However, the grounds of the two systems must still be tied together.

We now turn our attention to expansion port contacts 14 through 21. These are connected directly to the microprocessor's data bus and bear the designation of D7 through D0. Whenever the microprocessor sends data to or reads data from any of the support chips, the voltage pattern on these contacts will correspond to the value of the data. The presence of the data lines on the expansion port allows for the bidirectional transmission of data between the computer and any peripherals. All the computer's hardware resources share this data bus, including the RAM, ROM, VIC, SID, and CIA chips.

The value of each data line is equal to the number 2 raised to the power of its numerical position. For example, the value of D0 is equal to 2 raised to the power of 0. The value of D4 is 2 raised to the power of 4, or 2 multiplied by itself four times. The largest bit value is D7, which is 128. The sum of all the data bits would be 255. To evaluate a data byte, simply add up the bit values for all the bits at 5 volts or logical one.

Sixteen additional contacts, F through Y, represent the system's address bus. On the C-64 these lines are tied directly to the microprocessor. On the C-128 the address lines go through some decoding before being brought to the expansion port. On the C-128 the address bus is actually arranged in two groups of eight bits each. Contacts R through Y, the lower eight bits, are the shared address bus designated SA7 through SA0. Contacts F through P, the upper eight bits, are known as the translated address bus designated TA15 through TA8.

Addresses may be evaluated just like data bytes, except that there are twice as many bits to consider. The most significant bit is A15, which represents a value of 2 multiplied by itself 15 times, or 32768. The largest possible value which may be attained by the address bus is 65535. Don't forget to count address zero in the C-64's total of 65536 bytes of RAM. In addition to this RAM the C-64 contains 20 kilobytes of ROM and 4 kilobytes of addressable input/output (I/O). Since the 6510 microprocessor can only manage 64 kilobytes on its own it gets some help from a custom programmed logic array (PLA). We will look at this memory management in some detail later on.

The internal complexity of the C-128's address bus reflects the additional system resources which are provided with this computer. The C-128 has two microprocessors, two video display processors, and more than twice the RAM as well as over four times the ROM of the C-64. Management of all this hardware requires that precise control be maintained at all times.

The 8501 microprocessor in the C-128 is no better at memory management than the 6510 in the C-64. In fact the two microprocessors are functionally identical. To help out the 8501 the C-128 includes a sophisticated memory management unit (MMU) which was actually designed to cope with up to 256 kilobytes of RAM, as well as all the ROM and other good stuff. Since the C-128 can emulate the C-64, it also contains a version of the PLA. A description of the C-128's MMU is beyond the scope of this article. (Sorry folks, maybe some other time.)

We now turn our attention to the more specialized contacts on the expansion port. We expect that the next two contacts will be of great interest to many users of the C-64. Contacts 8 and 9 are designated $\overline{\text{GAME}}$ and $\overline{\text{EXROM}}$. The horizontal bar written across the top indicates that they perform their function when they are at zero volts, which is also a logical zero. This arrangement is sometimes referred to as active low.

Contacts 8 and 9 are directly connected to the C-64's PLA. As we mentioned above, the PLA is the chip which is responsible for managing the various memory configurations of the C-64 above and beyond the basic 64 kilobytes of RAM. The $\overline{\text{GAME}}$ and $\overline{\text{EXROM}}$ lines are normally main-

tained in a logical one state (+5 volts) by a connection to the 5 volt power supply through built-in resistors. When one or both of these contacts are pulled to a logical zero by simply connecting the contact to ground, the C-64's memory configuration will change.

The actual memory configuration is also dependent on the contents of addresses zero and one. These addresses are actually a hardware input/output (I/O) port built into the 6510 microprocessor. As a result it is actually impossible to access the first two bytes of the C-64's RAM. Address 0 determines which bits of address one will function as input or output lines. In particular it is bits 0, 1, and 2 of the 6510's I/O port which control memory. These are always set for output. The Commodore designation for these bits is $\overline{\text{LORAM}}$, $\overline{\text{HIRAM}}$, and $\overline{\text{CHAREN}}$. Like $\overline{\text{EXROM}}$ and $\overline{\text{GAME}}$, these three I/O bits are tied directly to the PLA. Bits 3, 4, and 5 of the I/O port are associated with the cassette port. Bits 6 and 7 are not used at all.

There is one memory configuration which is not affected by the contents of the 6510's I/O port. This occurs when $\overline{\text{GAME}}$ is pulled low and $\overline{\text{EXROM}}$ is high. This results in the Max memory configuration, which is named after the Ultimax computer. The Ultimax was intended to be a game machine and minimal C-64 with a membrane keyboard. It was never sold in this country, although we understand it achieved some popularity in Japan. The Max memory configuration may contain up to 16 kilobytes of cartridge ROM or RAM in the address ranges of \$8000 to \$9FFF (32768 to 40959) and \$E000 to \$FFFF (57344 to 65535) with only 4 kilobytes of active internal RAM in the address range of \$0000 to \$0FFF (0 to 4095). The I/O block at address range \$D000 to \$DFFF (53248 to 57343) is also active.

There are a total of 14 unique memory configurations possible with the C-64 as managed by the PLA. These are summarized in the table on page 59.

When interpreting the memory maps shown in the table, remember that these represent only what the 6510 microprocessor sees. Other system chips, such as the VIC chip, may see a different memory map. Note that configuration numbers 5 and 7 are identical to numbers 14 and 15.

The first five columns in the table show the status of the three memory control bits in the 6510's I/O port and the two hardware control lines on the expansion port. A 0 or a 1 in these columns corresponds to the logical status of the corresponding bit. An X in these columns indicates that the corresponding bit has no effect on the memory configuration. With the exception of the Max configuration in the last line, all memory maps have RAM in the address range of \$0000 to \$7FFF (0 to 32767). The Max configuration has RAM only in the first four kilobytes of this block. The address range of \$1000 to \$7FFF (4096 to 32767) is not used by the Max.

The term CART. in an address range column refers to the ROM or RAM in an external cartridge which has been installed in the computer's expansion port. The four kilobyte block from \$D000 to \$DFFF (53248 to 57343) may contain the I/O chips or the character generator ROM or RAM. The VIC chip always sees the character generator ROM in this block. The I/O chips also include one kilobyte of color RAM starting at \$D800 (55296). The terms BASIC and KERNAL refer to the respective ROMs which are built into the C-64.

It is possible to place the C-64 into any of the memory modes which are listed in the first seven rows of the table by POKEing an appropriate value into address 1. The BASIC command line might be:

```
POKE 1,(PEEK(1) AND (248+A))
```

The value of A is 7, 3, 6, 2, 5, 1, and 0 corresponding to the lines in the table. All of these values, except for the first two, will crash the machine as they will swap out BASIC, the Kernal, or both from the microprocessor memory map. The second value will disable the I/O, which of course includes the disk drive. It is possible to experiment with some machine language monitors which may not need the BASIC ROM for their operation; for example, the public domain *Micromon.* Since virtually everything requires the Kernal to update the screen display, it is generally not possible to view the RAM under the Kernal directly. The *Super Snapshot* cartridge reviewed last month will let you work with all of these configurations without crashing the machine.

The C-128 will have the same memory map configurations when in C-64 mode. If either $\overline{\text{EXROM}}$ or $\overline{\text{GAME}}$ are grounded, the C-128 will automatically revert to C-64 mode on power up or after a system reset. The C-128 also has two banks of color RAM in the one kilobyte \$D800 (55296) block. Refer to the *C-128 Graphic Bit Map* in the May 1986 *Ahoy!* to see how to manipulate the C-128 color RAM.

Getting back to the expansion port, we turn our attention to $\overline{\text{ROML}}$ at contact 11. $\overline{\text{ROML}}$ is an output line which goes high whenever $\overline{\text{EXROM}}$ is low and the current address falls in the range of \$8000 to \$9FFF (32768 to 40959). This line simply decodes the status of address lines A15, A14, and A13 along with $\overline{\text{EXROM}}$. If A14, A13, and $\overline{\text{EXROM}}$ are all low, and A15 is high, then $\overline{\text{ROML}}$ will go high. Contact B (ROMH) functions similarly for the address range of \$A000 to \$BFFF (40960 to 49151) when $\overline{\text{GAME}}$ or $\overline{\text{EXROM}}$ is low. In the Max configuration $\overline{\text{ROMH}}$ goes high for the address range of \$E000 to \$FFFF (57344 to 65535). The $\overline{\text{ROML}}$ and $\overline{\text{ROMH}}$ contacts are used to enable cartridge ROMs which map into their respective address ranges.

Contact 6, which bears the designation R/$\overline{\text{W}}$, indicates whether the microprocessor is performing a read or write operation. A logical 1 indicates a read while a 0 signifies a write.

At this point we have described enough of the expansion port's contacts to construct a ROM cartridge.

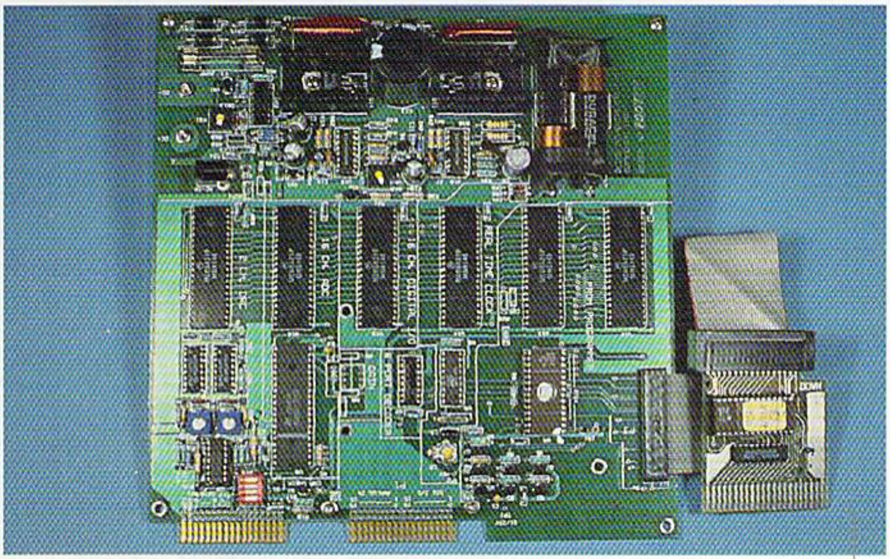
We have also run out of space for this issue. Next month we will show the wiring for two different C-64 cartridge types. We will show why as a rule only one cartridge may be used in the expansion port at a time and we will look at what has to be done to get around this limitation. We will also finish looking at the rest of the connections to the expansion port. ☐

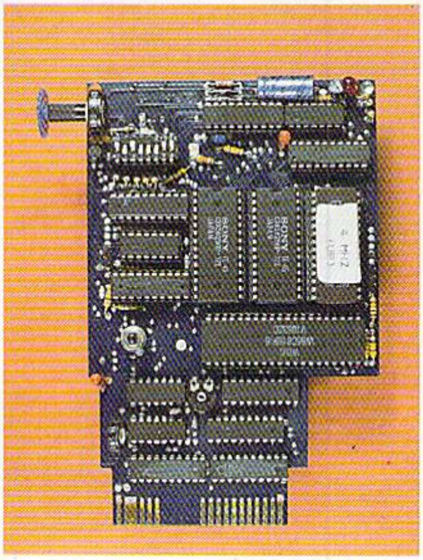
TURBO PROCESSOR
Swisscomp
Commodore 64
Cartridge; $189.95

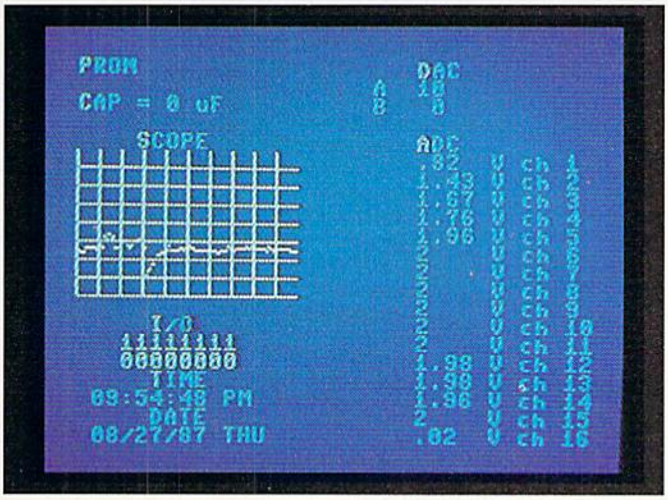
Faster is better! More bits are better! These are the maxims with which microcomputers are promoted today. In simpler terms, the faster the microprocessor runs and the more bits it can process with every instruction, the better is its performance. The very first microprocessor was the Intel 4004 which was developed in 1971. It could manipulate only four data bits at a time. It was able to address 1280 half-bytes, or nybbles, of data in conjunction with four kilobytes of programmed instructions. It ran at a clock rate of about 60,000 operations per second.

Just four years later the 6502 was developed by MOS Technology, a company which was subsequently bought by Commodore. The 6502 processes eight data bits at a time and it is able to address 64 kilobytes of data and instructions. It runs at a clock rate which lets it execute over one million instructions per second. The 6502 is the microprocessor used by most microcomputers built in the 70's and early 80's including the KIM, PET, VIC 20, C-64, the C-128, the Apple II series, and the 8 bit Ataris. Although the 6502 is not as big and fast as the latest crop of 32 bit number crunchers, the computers based on it are still in use.

The immense popularity of the 6502 has spurred independent development efforts to improve its performance. Less than three years ago the Western Design Center developed the 65C816, a 16 bit version of the 6502 which could also run more than four times as fast.







ABOVE: Microtroll's immediate mode screen display. Digital oscilloscope screen is to the left; monitoring of the 16 channel analog to digital convertor is on the right.

TOP LEFT: The Microtroll. A bigger C-64 cartridge will be hard to find. Power supply section occupies top third of board. Six 6821 PIA chips span center third. Across bottom third to left are digital/analog and analog/digital conversion sections. Clock/calendar is in center and PROM programmer with 8K user PROM is to right. Small board at end of ribbon cable contains the operating system in an additional 8K of ROM. This board connects to the 64's expansion port. All I/O is available at twin 34 pin edge connectors at bottom. The board has been predrilled for user installation of dual headers at connectors.
READER SERVICE NO. 211

TOP RIGHT: Largest chip on the Turbo Processor board is the 65C816. To its left is reset pushbutton; above it are 32K PROM chip and twin 32K RAM chips. Miniature control switches are in upper left corner next to variable speed control. Red LED in upper right is for power indication.
READER SERVICE NO. 210

PHOTOS BY MORTON KEVELSON



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Reader Service No. 170

To take advantage of the popularity of the 6502, the 65C816 architecture and instruction set is a superset of the 6502. This means that the 65C816 can be used as a replacement for the 6502 with minor hardware modifications.

C-64 owners were ecstatic! Here was the opportunity to replace but a single chip with the potential to improve the performance of their computers by a factor of eight. Alas, this was not the case. Although it was possible to perform the substitution, there was nothing to be gained by doing so. The operating system and the supporting hardware remained the same, which resulted in no change in performance. Nevertheless the possibility was intriguing to say the least, and Swisscomp with their Turbo Processor actually did something about it.

Swisscomp has developed a cartridge for the C-64 (not the C-128) which utilizes the 65C816 microprocessor. As with other cartridges it plugs into the expansion port and takes control of the machine. The result is that the C-64 is managed by a 16 bit microprocessor executing its instructions at speeds up to four million times per second.

In addition to the 65C816, Turbo Processor has its own 64 kilobytes of battery-backed static RAM, two operating systems in 32 kilobytes of ROM, and a collection of digital "glue" chips which hold everything together and provide the interface to the C-64. The board also has two potentiometers to fine tune the timing so as to match the C-64. A third potentiometer serves as an optional speed control allowing for the adjustment of clock speed over the range of one to four MHz. A set of eight miniature switches are used to configure the board according to the user's needs. A handy reset pushbutton is also provided.

All this hardware is crammed on a double sided 4" wide by 6" deep circuit board, of which four inches protrudes out the back of the computer. The variable speed control adds an additional quarter inch to the width. The rechargeable battery is positioned to provide a supporting foot at the back of the board. The circuit board is completely unenclosed, opening up the possibility of accidental contact with small (or large) metal objects. The lack of an enclosure, or any other shielding, may also result in local interference with TV and radio reception.

In operation the Turbo Processor emulates a C-64 running at about four times its normal speed. Since a direct emulation is being performed, there is no real utilization of the 65C816's 16 bit capabilities. Other than the addressing of ROM and RAM without bank switching, there is also no utilization of the microprocessor's 16 megabyte address space. The Turbo Processor's manual does mention the pending availability of a one megabyte expansion card. A close examination of the Turbo Processor did not reveal how this extra megabyte would be interfaced.

While we are on the subject of the manual we must point out that it was apparently translated from some other language to something which bears a passing resemblance to English. The resemblance was close enough that we were initially misled into believing it actually was written in English. We soon found out the truth as we were reduced to the trial and error technique of deciphering some of the Turbo Processor's operations. This was after we were blessed with a revision to the first version of the manual. We strongly suggest that Swisscomp USA retain the services of a qualified writer to come up with a better manual.

The user has a choice of several operating modes via the Turbo Processor's eight miniature switches. The default settings result in a standard C-64 running at a four MHz clock speed. This does not necessarily result in the expected four times speed improvement, as all of the I/O operations as well as the sound chip, video chip, and the built-in real time clock must still operate at the original one MHz clock speed. Nevertheless, speed increases greater than three times will be obtained even with BASIC programs. We clocked a simple FOR/NEXT loop at a better than 3.7 times speed increase. Including a simple floating point calculation in the loop still gave us a more than 3.5 times speed increase. Upon adding a print to the screen in each iteration of the loop we still found the speed factor to be greater than 3.3 times normal.

If you are a machine language programmer you can get even better performance, and if you can write 65C816

code for 16 bit operation you can do better yet. You will have to be rather clever about it, as the manual provides no information on how to access the 16 bit facilities of the 65C816.

Upon turning our attention to the control switches we found that the first switch simply disables the Turbo Processor, leaving a native C-64. This will let you run software, such as games, whose machine language timing loops would be affected by the increased clock speed. Unless you are an absolute masochist, you will not enjoy playing most arcade games at four times the usual speed.

The second switch enables the manual control of processor speed over a one to four MHz range. The third switch supports the replacement of the onboard 32 kilobyte ROM with a 64 kilobyte ROM. If you are ambitious and have the technical knowhow, you can write yourself up to two more operating systems to fit into this ROM.

The fourth switch banks in up to 16 kilobytes of cartridge ROM which may be on board the Turbo Processor. The manual mentions an assembler for this slot but gives no further details. The fifth switch selects between the two onboard operating systems. The default operating system is the C-64 emulation mode mentioned above. The alternate operating system supports an optional Turbo Loader kit which adds a parallel interface between the C-64 and the 1541 disk drive. We will discuss the Turbo Loader in a while. The alternate operating system also includes a full-featured DOS wedge with some programmer's aid extension to BASIC. The latter commands include auto line numbering, enhanced screen editing, a program unnew feature, and a rudimentary monitor. The monitor is limited to the display of memory and the loading or saving of program files.

The sixth switch permits asynchronous operation of the Turbo Processor with respect to the C-64. In this mode the two clocks will not be locked to each other and all access to the I/O will be lost. Synchronous operation may be resumed under software control. Asynchronous operation should result in an additional speed increase of 10% to 20%. We did not have the opportunity to verify this. The seventh and eighth switches control the hardware and software selection of the Turbo Processor's one MHz and four MHz operating speeds.

We have mentioned the 64 kilobytes of battery-backed RAM provided with the Turbo Processor. The battery for this RAM is a 2.4 volt, 100 milliampere hour nickel cadmium unit which may require recharging when the Turbo Processor is first powered up. This could take up to half an hour, during which time the C-64 will be disabled. Once charged up, the battery should be good for several months. Thus the problem is not likely to recur. The charging of the battery and the additional load of the Turbo Processor may pose a problem for C-64s with marginal power supplies.

Once the battery is recharged it will retain all data in the onboard RAM after the C-64 is turned off. This data will be instantly available when the computer is turned on. This includes any autostart programs which may be in RAM. In fact we initially had some difficulties getting out of an autostart program we had loaded in. Although the manual mentioned several power on methods under keyboard control which were supposed to bypass any autostart programs, we could not get any to work. Even the sequence which was supposed to clear RAM had no effect. We were about to resort to the unsoldering of the battery to clear the RAM when we tried switching to the alternate operating system. Wallah! Apparently all of the alternate startup procedures are implemented only in the alternate operating system—something which the manual was not too clear about.

The alternate operating system is required when the optional Turbo Loader kit is installed. This kit consists of a replacement ROM for the 1541 disk and a parallel connection cable between the 1541 and the C-64. Note that different kits are required for the 1541 and the 1541C. On the 1541 side you will have to remove the VIA chip which is closest to the drive's 6502 microprocessor. An adapter socket is then installed and the VIA chip is replaced. The cable taps into the unused 8 bit I/O port on this VIA chip. The other end of the cable is connected to the C-64's user port via an adapter card which also extends the port for other peri-

pherals. The card contains a second reset pushbutton (the first reset pushbutton is on the Turbo Processor card). The Turbo Loader resulted in a more than six times improvement in loading speeds.

Overall compatibility with disk-based software was quite good. The onboard switches made it simple to configure the Turbo Processor so it would run with any program. A close examination of the Turbo Processor's edge card connector revealed that several lines were not in use, in particular I/O 1, I/O 2, GAME, EXROM, ROML, and ROMH. If you have read the accompanying report on the expansion port (page 59), you will realize that these include the key lines by which the C-64 recognizes the presence of an external cartridge. Apparently the Turbo Processor uses the NMI line along with extensive direct memory access (DMA) to control the machine.

The unconnected control lines led us to the subsequent discovery that a plug-in ROM cartridge would not work while the Turbo Processor was active. The control of the machine is so complete that even when we hardwired EXROM and GAME to ground they were still ignored. Interestingly enough, we found an unexpected side benefit. A standard C-64 ROM cartridge could be plugged in parallel with the Turbo Processor by using a two-slot expansion chassis. No switching is required of either cartridge. When the Turbo Processor is active the ROM cartridge will be ignored. If the Turbo Processor is disabled the ROM cartridge will assert itself in the expected fashion.

The Turbo Processor is a fascinating hardware extension for the C-64. The increased speed it offers will be of value for many users, especially for productivity software. We found *Multiplan's* performance to be real snappy at four MHz. The major shortcoming of this package is the lack of complete documentation. A sophisticated product of this sort requires a detailed description of its operating system and hardware to be most effective. At the very least we would like to see support for the 65C816's 16 bit operating mode.

Swisscomp Inc., 5312-56th Commerce Park Blvd., Tampa, FL 33610 (phone: 813-628-0906).

—Morton Kevelson

MICROTROLL
Slide Mountain Systems
Commodore 64
Price: $180.00

As microcomputer users we often hear about input/output (I/O) without giving it a second thought. On occasion we might ponder just which part of the computer is I/O and why the topic always seems to crop up. The I/O is the part of the computer which lets it communicate with the outside world. The bottom line is that a microcomputer consists of a microprocessor, some associated memory (RAM and/or ROM), and a program to run. All the rest is I/O and in most computers the I/O actually represents a much greater investment than the basic machine. Although the bottom line computer may be quite content with its introspective cogitations, it would not be of much use to the rest of us. Without some means of finding out what it was up to or some way for us to guide its thoughts, it would not be likely to perform for our benefit.

In the C-64 we thus classify the game ports, keyboard, video display, SID chip, serial port, cassette port, and user port as I/O. As we show in our dissertation on the expansion port we may find I/O there as well. As a result, with an I/O here and an I/O there the C-64 becomes a most useful device. At this point we might very well believe that the C-64 is equipped with a more than ample supply of I/O. Not so! As with RAM, a computer can never have enough I/O. In spite of its innate versatility, the C-64 lacks the means to perform the vast majority of the mundane tasks which occupy our daily lives. When was the last time your C-64 prepared your dinner, made your bed, or commuted to work for you? Interestingly enough, many of today's appliances have built-in microprocessors which let them perform some of these tasks. However, these devices lack the necessary I/O, as well as the ability to readily change their program, which would provide them with the flexibility of the C-64. In fact they are microcomputers dedicated to a single task.

While the Microtroll from Slide Mountain Systems will not endow your C-64 with the above mentioned capabilities, it will vastly expand its I/O. Please note also that the Microtroll

READER SERVICE INDEX

The publisher cannot assume responsibility for errors in the above listing.

does not reside under a bridge, nor does it have any dealings with the three microgoats gruff which may happen to pass over. Physically the Microtroll is an imposing double sided, 9" circuit board. It interfaces with the C-64's expansion port via a 7" flat ribbon cable. The computer end of the cable is terminated in a small cartridge board which contains the Microtroll's 8 kilobyte operating system in ROM.

The Microtroll is supplied without an enclosure; however, the board is predrilled with appropriate mounting holes for easy installation in a suitable box. The end user should provide a suitable enclosure for physical protection as well as RFI shielding.

Power for the Microtroll is derived from an external 9 volt AC transformer rated at a bit over 3 amperes. The onboard power supplies convert this to the various DC voltages (+5 volts, +/−15 volts, +/−25 volts) required by the Microtroll. An alternate power source would be an unregulated 9 to 20 volt DC supply rated at two amperes. If the optional 3 volt batteries are installed, there will also be backup power for the onboard real time clock. Most of the available output from the power supply is used by the Microtroll. There is a small amount left over for user devices (5 volts at 250 milliamperes and +/−15 volts at 10 milliamperes.

The bulk of the Microtroll's circuitry consists of six 6821 PIA (peripheral interface adapter) chips, an ADC0817 analog to digital converter, a pair of DAC-08 digital to analog converters, an MSM5832 real-time clock/calendar, an 8 kilobyte EPROM, and the associated PROM programming circuitry. There are additional chip select lines for up to two more PIAs. The board even has mounting holes for user designed "piggy back" circuit boards.

The 6821 CIA is equipped with two bidirectional, 8 bit I/O ports. The ADC0817 is equipped with an 8 bit analog-to-digital converter with a 100 microsecond conversion time and a 16 channel multiplexer. The DAC-08s can accept 8 bit digital input data. The MSM5832 provides complete date and time information in a 12 or 24 hour format.

The onboard operating system is a hybrid of machine language and BASIC. On power on the BASIC portion of the operating system is downloaded into user RAM and linked to the machine language portion. The Microtroll then continues operating in its immediate mode. In immediate mode the operating system sets up an intricate display, as shown in the screen photograph on page 63, and waits for user input. This provides the following functions which illustrate the Microtroll's capabilities:

1. A capacitor checker with a basic range of 0.1 to 200 microfarads.

2. The real time clock display.

3. A rudimentary digital storage oscilloscope. The sampling interval can be adjusted from a range of a small fraction of a second to several days.

4. Monitoring and setting of the 16 digital I/O lines.

5. Direct access to both digital to analog conversion channels.

6. Display of the 16 analog to digital conversion routines.

7. Access to the PROM programmer for user programs.

The immediate mode program is intended to be expanded upon by the user. Up to an additional eight kilobytes of BASIC program may linked to the immediate mode routines. This program may then be permanently programmed into the onboard ROM. The Microtroll will then automatically link the user code into its BASIC operating system for automatic execution on power up. If the user code includes access to a disk drive, then program overlays can be used to extend the program even further.

The documentation provided with the Microtroll is extensive. It includes detailed descriptions of the hardware with complete schematic drawings. Thoroughly documented listings of both the BASIC and machine language portions of the operating system are provided, plus a full set of manufacturer's data sheets for major chips.

The Microtroll is intended for a variety of end users. At the very least it is a low cost I/O board with tremendous appeal to the hardware hacker. It can form the basis of a detailed education in the intricacies of microcomputer interfacing. The Microtroll will also be of interest to the industrial user, serving as a microcomputer-based control system for a variety of manufacturing processes. As such the Microtroll stands to save considerable inhouse engineering development time by providing an easy interface to a fully developed I/O interface.

Slide Mountain Systems, P.O. Box 6481, Colorado Springs, CO 80934 (phone: 303-449-4783).

—Morton Kevelson

AHOY!'S BULLETIN BOARD SYSTEM

Call *Ahoy!*'s BBS 24 hours a day, 7 days a week for information on upcoming issues, program and article corrections, and more.

Set your modem for 300/1200 baud, full duplex, no parity, 1 stop bit, and 8-bit word length, and dial 718-782-3239.

Continued from page 14

Prix courses, including Australia's Salzburgring and Great Britain's Silverstone. Two players can compete on side-by-side screens, or a single player against computer-controlled bikers. A sweepstakes sponsored by Broderbund will award a 650cc Suzuki motorcycle, plus 10 software libraries and 10 Broderbund sweatshirts.

Broderbund Software, Inc., 415-492-3200 (see address list, page 12).

128 DISK UTILITY

Peek a Byte 128 ($35.00), based on the C-64 disk/memory utility, allows users to read, edit, and write to any sector, edit the data, recover a scratched file, modify memory, and more. Data can be displayed as hex values, screen or PETASCII characters, or disassembled to machine code. Included are HELP screens listing all keystrokes, un-NEW programs, and the *Disk Mechanic*, offering the ability to read raw track GCR data, edit sector GCR data, read or write up to track 40 even with DOS header errors, and more.

Quantum Software, 305-622-7962 (see address list, page 12).

MIDI DITTIES

MIDImouse has announced a variety of new products for Commodore 64-interfaced musicians: ROM and RAM cartridges for use with a Commodore 64-interfaced Roland D-50 or ENSONIQ ESQ-1, sound programs on disk and tape for the TX81Z, FB-01, Matrix 6, and Matrix 12, and several new entries in the DIgital Horizon collection of sample disks.

MIDImouse Music, 503-622-4034 (see address list, page 12).

AMIGA SOFTWARE

Four productivity packages for the Amiga from Abacus:

The *TextPro* intermediate level word processor ($79.95) features fast on-screen formatting, automatic hyphenation, 30 user-definable function keys, flexible printer driver installation, and the capability to mix graphics with text.

The *BeckerText* professional word processor ($150) boasts WYSIWYG formatting, multiple (up to 5) column printing, realtime online dictionary, automatic index generation, and lines up to 999 characters.

DataRetrieve ($79.95) lets the database user define files and enter information using flexible screen templates. Data fields can be stored and displayed in different type styles and sizes, and easily changed in definition and format. Also included are search and sort capabilities and RAM disk support. Up to 8 files can be accessed simultaneously, and each record can contain up to 64,000 characters.

The *AssemPro* machine language development package ($99.95) comprises an integrated editor, high speed macro assembler with 32-bit arithmetic, debugger with 68020 single-step emulation, disassembler, and reassembler. The program runs from Workbench or using the CLI.

Abacus, 616-241-5510 (see address list, page 12).

REDIRECT

For the C-64 & C-128

By Buck Childress

Ever notice how your disk drive rarely enters a filename in the directory where you think it will—or should? How come the twentieth save can be first in line? There is a logical explanation, but it really doesn't matter when your directory has been thrown out of whack. I wonder if Murphy's Law applies here. What the heck! Put everything back in order with *Redirect.*

Redirect lets you put your disk directories in any order you want, quickly and easily. There are versions for both the C-64 and C-128. It works on either the 1541 or 1571 drive. Here's how to use it.

After saving a copy of *Redirect*, run it. You'll be prompted to enter a filename. After answering and pressing RETURN, *Redirect* verifies that the file exists, then asks for another filename. Enter it and press RETURN. *Redirect* again verifies the existence, then swaps the two locations in the directory. You can rearrange as many files as you want with ease. If you want to see the directory, press the $ key instead of entering a filename.

You'll notice that the prompts have a quotation mark in them. This puts your entry in quote mode and allows you to enter all keyboard characters (including CURSOR, HOME, FUNCTION, etc.), just in case you saved a file with a strange name. Don't put end quotes. *Redirect* automatically does this when you press RETURN.

After a swap is made, *Redirect* asks if you want to make another. Press Y if you do, N if you don't, or $ if you want to see the directory.

Since *Redirect* actually changes the directory entries, it's a good idea to test it on an unimportant disk first, in case you made any typos while entering it.

Give *Redirect* a spin in your drive. Put Murphy's Law back in the books instead of your disks. ☐

SEE PROGRAM LISTING ON PAGE 97

SPRITE-ON

For the C-64

By Buck Childress

Do those C-64 sprite positioning blues have you down? Are you chomping at the bit because you can't seem to get those little devils placed exactly where you want 'em without spending 27.3 hours POKEing 'em all over the screen? Relax! Place your sprites right on the spot, the easy way...with *Sprite-On.*

Sprite-On lets you move a sprite around the screen while it tells you the horizontal (X) and vertical (Y) positions. When you've got the sprite where you want it, you'll instantly know the X and Y locations to put in your program. Here's how to use *Sprite-On.*

After saving a copy, run it. The loader POKEs the machine language data into memory and checks for errors. It also creates a solid block sprite for you to move around. Now type SYS 53000 and press RETURN.

At the top of your screen you'll see the X and Y positions. Your little block sprite starts at 170 for both. The CURSOR keys move the sprite in the same direction as they do the cursor...left, right, up, or down, depending upon whether you're pressing the SHIFT key, too. If you want to slow the movement to a crawl, press the CONTROL key at the same time. As you move the sprite, the numbers change to reflect the new position. If the numbers turn to reverse video, you've crossed the seam. If you're not familiar with the seam, the *Commodore 64 Programmer's Reference Guide* explains it.

Sprite-On makes it a breeze to position sprites. Take the bit out of your mouth, throw the blues away, and get right on target, with *Sprite-On.* ☐

SEE PROGRAM LISTING ON PAGE 106

TIPS AHOY!

Compiled by Michael R. Davila

Contributors to *Tips Ahoy!* will be compensated at highly competitive industry rates immediately upon acceptance. Send your best programming and hardware hints to *Tips Ahoy!*, c/o Ion International Inc., 45 West 34th Street–Suite 500, New York, NY 10001. You must include a stamped and self-addressed envelope if you want your submissions returned.

MAGIC FORMAT

This is a short program that takes advantage of several of the C-64's inversed character symbols. After you type in the name for the disk header, the program will ERASE your disk, putting the name on it in an unusual fashion. The ultimate result is a directory that clears the screen and prints the disk name in white. It's an interesting change from the usual dull directory.

–Marty Grebing
Cape Girardeau, MO

```
•10 INPUT"[CLEAR]DISK NAME";NM$
•20 INPUT"DISK I.D. (2 CHAR.)";ID$
•30 OPEN15,8,15
•40 PRINT#15,"N0:"CHR$(141)CHR$(147)CHR$(
 5)NM$","ID$
•50 CLOSE 15
```

RESAVER 128

Resaver 128 is a utility that eliminates the risk associated with the infamous Save With Replace function of Commodore's DOS.

If you've used the Save With Replace function (e.g.: DSAVE"@filename"), you may have been bitten by the Save With Replace demon. It strikes randomly but effectively, corrupting files on your disk. Some experts say the demon does not exist; nevertheless, I've been bitten by it! With *Resaver 128* activated in your system, the demon will never have anything to byte into again!

Resaver 128 works by patching into the Save vector ($332-$333) which normally points to the Kernal Save routine. Whenever a file is to be saved, *Resaver 128* first attempts to scratch the file entry from the disk before turning control over to the Kernal Save routine. Therefore, never use the @ symbol when saving a file (*Resaver 128* takes care of that for you). Also, if you are going to use the ML monitor to save a file, precede the filename with a colon. Example: S":filename",08,1400,1420.

Resaver 128 only occupies 46 bytes of RAM, which is a small price to pay to keep the demon away. As listed, the utility is stored starting at 5555. But by changing the value of S, it can be relocated elsewhere. The utility is deactivated with the RUN STOP and RESTORE combination, and reactivated with a SYS to the starting location.

–Shawn K. Smith
Bronx, NY

```
•100 REM* RESAVER 128 ---- SHAWN K. SMITH
•110 S=5555:B=46:REM S RELOCATES UTILITY!
•120 FORD=STOS+B:READY$:POKED,DEC(Y$)
•130 NEXT:X=S+11:L=INT(X/256)
•140 POKES+45,PEEK(818):POKES+B,PEEK(819)
•150 POKES+3,L:POKES+1,X-256*L:SYS(S)
•160 PRINT:PRINT"RESAVER 128 ACTIVATED!
•400 DATA A9,00,A2,14,8D,32,03,8E,33,03
•410 DATA 60,A5,BA,20,B1,FF,A9,6F,85,B9
•420 DATA 20,93,FF,A9,53,20,A8,FF,A0,00
•430 DATA 20,AE,F7,20,A8,FF,C8,C4,B7,D0
•440 DATA F5,20,AE,FF,4C,00,00
```

ALTERNATOR

Have you ever wanted to store your high resolution screen into another part of the C-128's memory, so that you could work on a different screen while still being able to access your original screen? *Alternator* is definitely your answer.

This short relocatable machine language routine will switch between two hi-res screens. One screen will be stored in memory, while the other is currently being viewed. Since the bit map will be stored in Bank 1, you must first reserve memory for the screen. To do this, simply add a line with 'POKE 58,219:CLR' to your BASIC program. Whenever you want to swap screens, use a SYS S, where S is the starting address of where the ML routine is stored. (Note: To see the effects of *Alternator*, it is best to first enter the high resolution mode of the C-128 and then execute the routine.)

When you first swap screens, you will see a screen full of garbage. Simply clear the hi-res screen with another 'GRAPHIC 1,1' and LOAD or design your alternate hi-res screen. Now, every time you execute the routine, the screens will be switched.

–Michael Jaecks
Alamogordo, NM

```
•10 REM ALTERNATOR BY MICHAEL JAECKS
•20 REM  INCLUDE 'POKE 58,219:CLR' AT
•30 REM  THE BEGINNING OF YOUR BASIC
•40 REM  PROGRAM IN ORDER TO RESERVE
•50 REM  MEMORY IN BANK 1
•60 S=4864
•70 FORI=0TO61:READA:POKES+I,A:B=B+A:NEXT
 I
•80 IFB<>10168THENPRINT"ERROR IN DATA!":E
 ND
•90 PRINT:PRINT"SYS"S"TO SWAP SCREENS"
•100 DATA 169,0,133,250,133,252,169,28
•110 DATA 133,251,169,219,133,253,160,0
•120 DATA 177,250,72,169,252,162,1,32
•130 DATA 116,255,145,250,169,252,141
•140 DATA 185,2,104,162,1,32,119,255,169
•150 DATA 63,197,250,208,5,197,251,208
•160 DATA 1,96,230,250,230,252,208,216
•170 DATA 230,251,230,253,208,210
```



SUPER DISK UTILITIES

for the C128 & 1571

Super Disk Utilities is the ultimate utilities disk for the 1571 disk drive and C128 computer. Super Disk Utilities is a full featured disk utility system that will perform virtually every CBM DOS function available. No need for numerous utility disks to perform various functions. SDU does it all!

- Copy whole disks (with 1 or 2 drives)
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- Edit any track or sector with the Super Disk Editor
- Perform numerous DOS functions such as rename a disk, rename a file, change disk format (without affecting data), scratch or unscratch files, lock or unlock files, erase a track or a whole disk, create auto-boot and much more!

SDU helps you learn the inner workings of the 1571 drive with the 1571 Memory Monitor and unique RAM Writer. With these options you can assemble, disassemble any section of drive RAM or ROM. Use the Ram Writer to program the 1571 RAM yourself! SDU uses an options window to display all possible choices available at any given time. No need to memorize hidden commands. SDU fully supports a second 1571 drive. Many of the utility functions also work on the 1541 drive. SDU performs many MFM utility functions including analyze MFM disk format, format MFM disks, read a CP/M + directory, format in CP/M + (GCR format) and more. Super Disk Utilities is available for only $39.95!

THE COMMUNICATOR

Fastest, easiest, most efficient, most feature-packed terminal program for the C64. Among its many features are:

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- Very large buffer capacity
- Macro Key options
- Send/receive files with or without X-modem protocols
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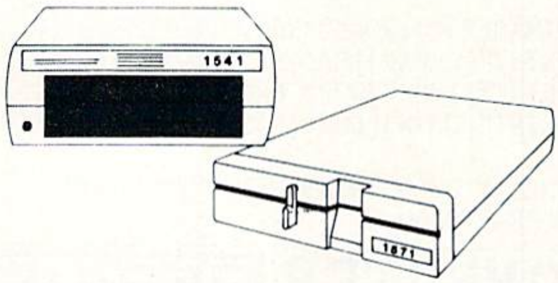
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Super 64 Librarian - Disk cataloger for the C64 - **$29.95**

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1541/1571 Drive Alignment reports the alignment condition of the disk drive as you perform adjustments. On screen help is available while the program is running. Includes features for speed adjustment and stop adjustment. Complete instruction manual on aligning both 1541 and 1571 drives. Even includes instructions on how to load alignment program when nothing else will load! Works on the C64, SX64, C128 in either 64 or 12 mode, 1541, 1571 in either 1541 or 1571 mode! Autoboots to all modes. Second drive fully supported. Program disk, calibration disk and instruction manual only **34.95!**

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WORD PROCESSOR

If you have a Commodore 64 and can't afford a costly word processor, you should like this little tip. This short program is a small word processor that lets you type up to 16000 characters (400 lines), then print them. After every 2 lines you type (80 characters long) you have to press RETURN to place them into memory. When you press RETURN the screen turns red for a second. While it is red you have a chance to print whatever you have typed on the printer by pressing P. Note that if you have left 2 lines (80 characters long) blank, the program will think it's the end of whatever you're printing and will stop printing it. Also, when it has finished printing, it automatically returns to the beginning.

—Kevin M. Ashby
Mississauga, ONT

```
•10 DIMA$(200):POKE53280,0:POKE53281,0
•20 PRINT"[CLEAR][RED][7"[DOWN]"]"
•30 PRINT"[13" "]WORD PROCESSOR"
•40 PRINT"[DOWN][DOWN][13" "]BY KEVIN ASH
 BY"
•50 FORT=1TO3000:NEXT:PRINT"[CLEAR]"
•60 FORF=1TO200
•70 INPUTB$
•80 A$(F)=B$
•90 POKE53280,2:POKE53281,2:FORH=1TO100:G
 ETR$
•100 IF R$="P"THEN 140
•110 NEXTH
•120 POKE 53280,0:POKE53281,0
•130 NEXTF
•135 PRINT"SORRY NO MORE SPACE WOULD YOU
 LIKE TO PRINT":INPUTY$
•137 IF Y$="Y"THEN 140
•138 IF Y$="N"THEN END
•139 GOTO 135
•140 OPEN1,4:CMD1:FORF=1TO200
•150 PRINT A$(F)
•160 IF A$(F)="" THEN PRINT#1:CLOSE1:GOTO
 175
•170 NEXT
•175 POKE 53280,0:POKE53281,0
•176 CLR
•180 GOTO 10
```


WINDOW BORDER

Seems to me that windows in 80 columns are great, except they never have borders that are usable. This shortie provides as simple a border routine as my simple mind can create. It not only provides a routine for bordering menus or announcements, but includes simple GOSUBS for uninitiated starts in the program. I use these routines for our club BBS newsletter.

Note that 60000-end is the main frame. 60100 is a centering device. Titles can be added to the early lines in GOSUBs to be centered. Text can be entered as print statements. It works well for me.

—John M. Elwood
Little Rock, AR

```
•10 PRINT CHR$(14)
•20 PRINT"[HOME]"
•100 A$="[s M][s E][s M][s B][s E][s R][s
 S] [s A][s N][s N][s O][s U][s N][s C][
 s E][s M][s E][s N][s T][s S]"
•110 GOSUB 60000
•200 PRINT"[s U]SE [s G][s O]-[s S][s U][
 s B]S TO DIRECT YOUR MENU TO YOUR COMMEN
 TS."
•202 PRINT"OR SUB-DIRECTORIES."
•204 PRINT"[s U]SE ANOTHER [s G][s O]-[s
 S][s U][s B] FOR [s G][s E][s T][s K][s
 E][s Y]"
•206 PRINT"[s G][s O]-[s S][s U][s B] TO
 ENTER A CHOICE[4"."]"
•208 GOSUB 10000
•210 SCNCLR:PRINT"[s S]TOPPED ON LINE 210
 ":STOP
```

```
•220 STOP
•6030 GOSUB 60100
•6040 GOSUB 10000
•9000 REM MENU
•9010 SCNCLR
•9020 A$="[s M][s E][s N][s U] [s F][s O]
 [s R] [s C][s O][s M][s M][s E][s N][s T
 ][s S]/[s S][s U][s B] [s S][s C][s R][s
  E][s E][s N][s S]"
•9030 GOSUB 60100
•9040 GOSUB 10000
•10000 PRINT"[s P]RESS '[s N]' FOR NEXT P
 AGE"
•10010 PRINT"[s P]RESS '[s M]' FOR MENU"
•10020 GOSUB 50000
•50000 GETKEY K$
•50010 IFK$=""THEN50000
•50020 IFK$="M"ORK$="[s M]"THEN9000
•50030 IFK$="N"ORK$="[s N]"THEN210
•60000 SCNCLR
•60010 COLOR6,11:COLOR5,1
•60020 B$="[s -]":TL$="[c A]":TR$="[c S]"
 :BL$="[c Z]":BR$="[c X]"
•60030 LL$="[50"[s *]"]"
•60040 PRINTSPC(10)TL$+LL$+TR$
•60050 FOR I =1TO22:PRINTTAB(10)B$TAB(61)
 B$:NEXTI
•60060 PRINTSPC(10)BL$+LL$+BR$
•60070 WINDOW11,1,60,21
•60075 COLOR5,8
•60100 PRINTTAB((50-(LEN(A$)))/2)A$
•60105 COLOR 5,1
•60110 FORI=1TO50:PRINT"[c T]";:NEXTI
•60120 RETURN
```


DRIVE PATROL

Ever switch your disk drive off while a program is running? Maybe you want to let it cool down or get a bite to eat. Many programs access the drive but, unfortunately, most of them don't check the drive's status before they attempt to use it. So, if you accidentally leave it off, the results can be, shall we say, upsetting...crashed programs or lost data...what a mess!

Whether you're a BASIC or machine language programmer, *Drive Patrol* will protect you. *Drive Patrol* lets you know if the drive is off before your program tries to access it. *Drive Patrol* freezes everything until you give it the go ahead. There are versions for both the C-64 and C-128. There's also a version for the C-128 using an 80 column display. It works with both the 1541 and 1571 disk drives.

Drive Patrol is really a subroutine that can be appended to your own programs. Just have your programs GOSUB or GOTO DRIVE PATROL to POKE the data into memory. Be sure to use the correct routine for your computer and display. The default address is 700 for the C-64 and 3072 for the C-128. These addresses can be relocated by changing the variable S in line 63002.

Drive Patrol is easy to use. Just prior to any call for disk drive operation (OPEN, LOAD, SAVE, etc.), have your BASIC program SYS to DRIVE PATROL–SYS 700 for the C-64 and SYS 3072 for the C-128 (or to your new location, if you changed it). If you're an ML programmer, you can save the object code and JSR or JMP to it from within your ML programs.

If your drive is off, *Drive Patrol* freezes everything and the border on your monitor changes color. On the C-128 with an 80 column display, the entire screen changes color. Should this happen, flip on the drive and insert the necessary disk. Now press the SHIFT and CONTROL keys at the same time. The screen returns to its original color and your program will zip along as though nothing ever happened.

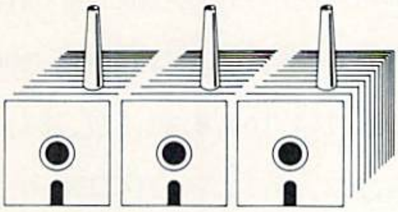
You can check out *Drive Patrol* by itself. Run it and leave your drive on. Type SYS 700 for the C-64, or SYS 3072 for the C-128, then press RETURN. Nothing happens. Now turn the drive off, SYS to it again, and watch the screen. Okay, press the SHIFT and CONTROL keys and see what happens.

Remember, if you're using *Drive Patrol* in a program when the screen changes color, turn on the drive and insert a disk *before* you press the keys. –Buck Childress
Salem, OR

C-64 VERSION

```
•63000 REM *** DRIVE PATROL (C-64) ***
•63002 S=700:REM *** CHANGE S TO RELOCATE
```

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```
 ***
•63004 FORJ=STOS+47:READA:POKEJ,A:X=X+A:N
 EXTJ
•63006 IFX<>6790THENPRINT"ERROR IN DATA[3
 "."]":END
•63008 DATA165,254,72,169,2,133,254,198,2
 54,48,31,169
•63010 DATA0,133,144,169,8,32,177,255,32,
 183,255,16
•63012 DATA238,238,32,208,173,141,2,201,5
 ,208,249,206
•63014 DATA32,208,169,0,133,198,104,133,2
 54,76,174,255
```

C-128 VERSION

```
•63000 REM *** DRIVE PATROL (C-128) ***
•63002 S=3072:REM *** CHANGE S TO RELOCAT
 E ***
•63004 FORJ=STOS+47:READA:POKEJ,A:X=X+A:N
 EXTJ
•63006 IFX<>6860THENPRINT"ERROR IN DATA[3
 "."]":END
•63008 DATA165,254,72,169,2,133,254,198,2
 54,48,30,169
•63010 DATA0,133,144,169,8,32,177,255,32,
 183,255,16
•63012 DATA238,238,32,208,165,211,201,5,2
 08,250,206,32
•63014 DATA208,169,0,133,208,104,133,254,
 76,174,255,0
```

C-128 80 COLUMN VERSION

```
•63000 REM *** DRIVE PATROL (C-128) 80 CO
 LUMN DISPLAY ***
•63002 S=3072:REM *** CHANGE S TO RELOCAT
 E ***
•63004 FORJ=STOS+71:READA:POKEJ,A:X=X+A:N
 EXTJ
•63006 IFX<>9448THENPRINT"ERROR IN DATA[3
 "."]":END
•63008 DATA165,254,72,169,2,133,254,198,2
 54,48,50,169
•63010 DATA0,133,144,169,8,32,177,255,32,
 183,255,16
•63012 DATA238,162,26,142,0,214,174,0,214
 ,16,251,238
•63014 DATA1,214,165,211,201,5,208,250,16
 2,26,142,0
•63016 DATA214,174,0,214,16,251,206,1,214
 ,169,0,133
•63018 DATA208,104,133,254,76,174,255,65,
 0,72,0,83
```

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We've collected Ahoy!'s best programs onto the Anthology Disks described here. Please note that many of these programs will be unusable without the documentation printed in the issues of Ahoy! listed in parentheses.

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COMMODARES
PROGRAMMING CHALLENGES
By Dale Rupert

Each month, we'll present several challenges designed to stimulate your synapses and toggle the bits in your cerebral random access memory. We invite you to send your solutions to:

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We will print and discuss the cleverest, simplest, shortest, most interesting and/or most unusual solutions. Be sure to identify the *name* and *number* of the problems you are solving. Also show sample runs if possible. Be sure to tell what makes your solutions unique or interesting, if they are.

Programs on diskette (1541 format only) are welcome, but they must be accompanied by listings. You must enclose a stamped, self-addressed envelope if you want any of your materials returned. Solutions received by the middle of the month shown on the magazine cover are most likely to be discussed, but you may send solutions and comments any time. Your original programming problems, suggestions, and ideas are equally welcome. The best ones will become *Commodares*!

PROBLEM #48-1: COIN CHALLENGE

This problem was submitted by Wally Sito (Iselin, NJ). Write a program which determines whether the value of the coins entered is more than, less than, or equal to one dollar, and displays the exact value. The program should ask for the numbers of each type of coin from penny through half-dollar. Let's see some solutions to this from you first-time *Commodarers*.

As an added challenge for you veterans, specify the coins needed, or identify the excess coins to make exactly one dollar.

PROBLEM #48-2: RANDOM WALK

Justin Smalley (Boulder, CO) suggested this challenge. He described the random walk as being the simplest random fractal (see *Fractals* in the April 1987 *Rupert Report*). A random walk will be defined to be a movement one unit of distance either up, down, left, or right. Write a program to display a random walk. You may use a single character to display the current position and all previous positions of the cursor. The cursor should not move off the screen, and the screen should not scroll.

A more advanced challenge is to use one type of character to show the current position and a different character at the cursor's previous positions. Justin also suggests using the standard Commodore graphics line characters to show the path. C-128 users may prefer to use graphics commands.

PROBLEM #48-3: TIME MACHINE

The user enters the current time and a number of minutes. The program calculates and displays the time which is that many minutes before and after the current time. For example, if the user enters 8:43 and 20, the computer displays 8:23 and 9:03. This shouldn't be any harder than it sounds, should it?

PROBLEM #48-4: MORE INCOME

Write a program to solve this old standard. You are offered a job with an annual salary of $15,000. You must choose between one of two salary increase plans: either get a raise of $3000 every year, or get a raise of $750 every six months. Which plan would you choose? Your program should display the payment schedules for both plans.

We have a very smart, sophisticated group of readers who send their results each month. It is always a pleasure to read such informative explanations and ideas. The hardest part is deciding which programs to list. Correct solutions which we didn't have room for this month were sent by:

R.C. Marcus (Agincourt, ONT)	Cliff Dedmore (Kaneohe, HI)
Louis Allen (Ft. Pierce, FL)	W. Eisenhauer (Beaverton, OR)
Jim Aspin (Flint, MI)	David Hoffner (Brooklyn, NY)
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David Brouse (Harrisburg, PA)	Gene Oakley (Coram, NY)
Carlos Centeno (Lares, PR)	Luis Padua (Mexico City, MX)

As we have mentioned before, a brief description of the nuances and significant aspects of your solutions is the best way to guarantee that your program gets a second look. It does not take a book to document a 10-line program, but a sentence or two might ensure that we do not overlook the merits of your work.

This month we will look at the best solutions to *Commodares* from the August 1987 edition of *Ahoy!* Even though James Bickers (Shepherdsville, KY) warned us that his *Problem #44-1: Added Difficulty* was *hard*, several readers took the challenge in stride (although several admitted that this one was definitely tough). The problem was to print all possible sums of positive integers which equal a given integer. The numbers in each sum must be in order, and no repeated sums are allowed.

This solution for the C-128 from Timothy Slate (Brattleboro, VT) is the most compact (should I say "the densest") one received.

```
•1 REM ================================
•2 REM    COMMODARES PROBLEM #44-1 :
•3 REM       ADDED DIFFICULTY
•4 REM    SOLUTION BY
•5 REM       TIMOTHY SLATE
```

```
•6 REM ====================================
•10 INPUT"[CLEAR][DOWN]ENTER A COUNTING N
 UMBER HIGHER THAN 1  ";NU:IFNU<2ORNU<>IN
 T(NU)THEN10:ELSEDIMSP(NU+1):SP(1)=1:PS=1
 :D$=CHR$(20):DO:NM=0:FORT=1TOPS-1:NM=NM+
 SP(T):NEXT
•20 Q1=NU-NM:IFQ1>0THENFORT=TTOT+Q1-1:SP(
 T)=1:NEXT:FORT=TTONU+1:SP(T)=0:NEXT:GOSU
 B50:SP(PS)=SP(PS)+1:PS=PS+1:LOOP:ELSEIFQ
 1=0THENSP(PS)=0:GOSUB50
•30 PS=PS-2:IFPSTHENSP(PS)=SP(PS)+1:PS=PS
 +1:SP(PS)=1:LOOP:ELSEEND
•40 FORT=1TONU:IFSP(T)>1ANDSP(T)<SP(T-1)T
 HENRETURN:ELSENEXT:IFQ1THENFORT=1TOQ1:PR
 INT"1+";:NEXT
•50 FORT=1TOPS-1:PRINTMID$(STR$(SP(T)),2)
 "+";:NEXT:IFSP(2)THENPRINTD$:RETURN:ELSE
 PRINTD$D$D$:PRINT"DONE"
```

Although Timothy sent a description of this program, it is still difficult to explain its workings. For this one, the proof is in the pudding. It works, so use it. The best way to understand it is to "play computer" with paper and pencil.

Here is a good C-64 solution to the same problem from Jim Lostetter (Kelseyville, CA).

```
•1 REM ====================================
•2 REM    COMMODARES PROBLEM #44-1 :
•3 REM      ADDED DIFFICULTY
•4 REM    SOLUTION BY
•5 REM      JIM LOSTETTER
•6 REM ====================================
•20 INPUT"[CLEAR]SHOW ALL COMBINATIONS TH
 AT ADD UP TO";N
•30 F=F+1:IFF>N/2THENPRINTC;"COMBINATIONS
 ":END
•40 M=F+1:L(0)=F:LS=F:GOSUB100
•50 L(L)=L(L)+1:LS=LS+1:IFL(0)+F>N THEN30
•60 IF L>0 AND L(1)>L(0) THEN L=0:LS=L(L)
 :GOTO 50
•70 GOSUB 100:MS=M:GOSUB 100:MS=0:IFL(L)<
 =M THEN 50
•80 L=L+1:L(L)=M+1:LS=LS+L(L) :IF LS+F<=N
 THEN 70
•90 L=1:LS=L(L)+L(0):GOTO 50
•100 REM SUBROUTINE
•110 FS=N-LS-MS :IF FS<F OR FS/F<>INT(FS/
 F) THEN RETURN
•120 FOR P=F TO FS STEP F:PRINTF;:NEXT:IF
 MS=0 THEN 140
•130 FOR P=M TO MS STEP M:PRINT M;:NEXT
•140 FOR P=L TO 0 STEP-1:PRINT L(P);:NEXT
 :PRINT:C=C+1
•150 IF MS=0 THEN RETURN
•160 MS=MS+M:GOTO 110
```

Jim said he succeeded with this solution in about a week, then spent another two weeks condensing it. His variables correspond to the names Number, First, FSpace, Middle, MSpace, Last, and LSpace. Again, to really understand this program, you must step your way through it.

Carlton Burton (Easton, TX) sent a very interesting, but lengthy, solution written in Pascal. Carlton stored the addends in a linked list for flexibility. If you would like a copy of the Pascal listing, send me a self-addressed (long) stamped envelope with your request clearly stated.

Congratulations also to David Shobe (Lawrence, KS–Rock Chalk Jayhawks!), Matt Shapiro (Fort Lee, NJ), and Jim Speers (Niles, MI) for their solutions. Jim suggested that this problem would be more easily solved in a language which allows recursive subroutine calls. No doubt a list-processing language such as LISP could solve this problem very simply. Any LISP programmers out there to meet the challenge?

Before we take a breather, let's look at some solutions to another workout, *Problem #44-2: Frank's Children* submitted by Necah Buyukdura (Ankara, Turkey). The description of the problem is longer than Necah's solution to it. The problem concerns Frank's five children:

1. Andy is older than Bill by half of Carl's age.
2. Bill is older than Emma by half of Andy's age.
3. Carl is older than Emma by two years plus twice Emma's age.
4. Dave is one year older than Emma.
5. Emma's age is one-fourth the sum of Carl's and Dave's ages.

Calculate and print a list of Frank's children's ages.

This was a very unusual problem in several ways. First of all, it has no solution. Second, of the grand total of 14 solutions submitted, only five of those correctly concluded that there was no solution. Third, and most surprising of all, the nine readers who said there was a solution all made the same incorrect interpretation of the problem and obtained the same wrong answers. Fourth, Keith Kushner (Brooklyn, NY) correctly surmised that the statement about Carl's age was wrong, and he figured out what it should have been!

The third statement should have read "Carl is older than Emma by two years plus Emma's age." (Perhaps the nine readers who found a solution assumed this correction, although none of them mentioned it.)

As stated, the third statement gives the equation $C = 2 + 3*E$. The correct statement leads to the equation $C = 2 + 2*E$. With the correct statement, the ages turn out to be 14, 10, 8, 4, and 3 for the five children in alphabetical order.

Keith Kushner did some algebraic manipulations to arrive at the equations in his solution shown here.

```
•1 REM ===================================
•2 REM    COMMODARES PROBLEM #44-2 :
•3 REM     FRANK'S CHILDREN
•4 REM    SOLUTION BY
•5 REM     KEITH KUSHNER
•6 REM ===================================
•10 R$=CHR$(13):FORE=1TO99:D=E+1:C=2*E+2:
 B=2*E+C/2:A=2*E+C:ON-(E=(C+D)/4)GOSUB20:
 NEXTE:END
•20 PRINT"ANDY:";A;R$;"BILL:";B;R$;"CARL:
```

```
";C;R$;"DAVE:";D;R$;"EMMA:";E;R$:RETURN
```

This neat little program tries ages 1 through 99 for Emily. The fifth equation is contained in the ON/GOSUB statement. If E is one-fourth the sum of Carl's and Dave's ages, then $-(E=(C+D)/4)$ has the value of 1 (remember that the conditional statement $E=(C+D)/4$ has the value -1 if it is true and 0 if it is false). Consequently the program calls the subroutine at line 20 only when the conditional statement is true. Otherwise the program falls through to the NEXT E statement. This program would print all solutions (assuming Emma is not a centenarian) if there were more than one. Necah included this most-impressive solution to his own problem.

```
•1 REM ====================================
•2 REM    COMMODARES PROBLEM #44-2 :
•3 REM     FRANK'S CHILDREN
•4 REM    SOLUTION BY
•5 REM     NECAH BUYUKDURA
•6 REM ====================================
•10 A=B+C/2 : B=E+A/2 : C=2+2*E : D=E+1 :
 E=(C+D)/4
•20 IF (A=V)+(B=W)+(C=X)+(D=Y)+(E=Z)+5 TH
EN V=A : W=B : X=C : Y=D : Z=E : GOTO 10
•30 PRINT"ANDY:";A,,,,"BILL:";B,,,,"CARL:
";C,,,,"DAVE:";D,,,,"EMMA:";E
```

According to Necah, this program uses a form of recursion. This program finds the solution after a number of iterations. Initial values for A through E are calculated in the original equations in line 10. Initially A and B are 0, C is 2, D is 1, and E is ¾ from this line.

The conditional expression in the IF/THEN statement has a value of 0 (false) only when A through E equal V through Z respectively. Since V through Z are 0 initially, and since only A and B are 0, the expression has a value of 3 (true), and the THEN clause is executed.

This begins the second iteration. New values are assigned to V through Z, and A through E are reevaluated. Eventually the values of A through E converge to the solutions of the problem. If you want to see the iterative steps, add this line to the program. It makes the process seem almost magical:

```
15 P=P+1 : PRINT "PASS NO.";P : PRINT A;
B;C;D;E
```

Necah said that this method works in solving many problems involving simultaneous equations. However some sets of equations tend to *diverge* rather than *converge* to the desired results. See this for yourself with these equations in line 10:

```
10 A=(E+2)/4 : B=D-A : C=B+4 : D=2*A+3 :
E=3*B+1
```

The second equation has a negative term which causes divergence. But all is not lost. Simply move the second equation to the first or last position and the problem is solvable in 151 passes. Furthermore, with the second equation in the fourth position, a solution is reached in only 77 iterations. Thanks to Necah for this very informative discussion.

Wallace Leeker said this problem reminded him of this story he read 20 years ago. An old man died, leaving 17 horses to his three sons. The oldest son was to get half of the horses, the middle son gets one-third, and the youngest son gets one-ninth of the horses.

Since ground horse meat was out of the question, the sons called in the wise man who provided this solution. He lent the sons one of his horses, making 18. One got half, 9 horses; one got one-third, 6 horses; and one got one-ninth, 2 horses. Since this was a total of 17 horses, the wise man took his horse back, and everyone was happy (except you who now must figure out what is going on here!).

Problem #44-3: Inner String challenged you to write an unordered INSTR (instring) routine. The user enters two strings. The program tells whether or not all the letters of the first string are contained within the second string regardless of order. Any duplicate letters in the first string must be duplicated in the second.

Among the shortest solutions was this one from Larry Schafer (Fowler, MI).

```
•1 REM ====================================
•2 REM    COMMODARES PROBLEM #44-3 :
•3 REM     INNER STRING
```

```
•4 REM    SOLUTION BY
•5 REM     LARRY SCHAFER
•6 REM ====================================
•10 DIM P(80):INPUT A$,B$:FOR J=1 TO LEN(
 A$):FOR A=1 TO LEN(B$)
•20 IF MID$(B$,A,1)=MID$(A$,J,1) AND P(A)
 <>1 THEN P(A)=1:NEXTJ:PRINT"YES":END
•30 NEXTA:PRINT"NO":END
```

Larry uses P( ) as a flag array to keep track of which letters in B$ have been used. Each letter in A$ is checked for the same letter in B$. If the letter is found in B$ and P(A) is not 1, indicating that the letter in B$ has not already been used, the J loop is repeated to test the next letter in A$.

Larry's use of a separate array to keep track of the letters used in B$ gives a speed advantage at the slight expense of additional memory. Most other solutions used string instructions to modify F$, deleting each used character from it. For example, when the Jth letter in B$ is used, that letter is eliminated from B$ with one of these string concatenation instructions:

```
B$=LEFT$(B$,J-1) + RIGHT$(B$,LEN(B$)-J)

B$=LEFT$(B$,J-1) + MID$(B$,J+1)
```

The second statement has the advantage of not needing the length of B$. The MID$ statement is most often used with three parameters: MID$(B$,Starting Position,Number of Characters). One of the more obscure of the MID$ instruction is that if the third parameter is omitted, as shown above, the entire right hand portion of the string is used beginning at the Starting Position.

Do you see that MID$(B$,J) is not the same as RIGHT$(B$,J)? The MID$ starts at position J and takes all characters to the right end of B$, whereas the RIGHT$ takes J number of characters counted from the right end of the string. If B$="HELLO" and J=2, then MID$(B$,J) is "ELLO", and RIGHT$(B$,J) is "LO". (For what value of J are the two statements equivalent? Look at the two concatenation instructions discussed above.)

The only other different approach to this problem was in this program submitted by David Shobe (Lawrence, KS).

```
•1 REM ====================================
•2 REM    COMMODARES PROBLEM #44-3 :
•3 REM     INNER STRING
•4 REM    SOLUTION BY
•5 REM     DAVID SHOBE
•6 REM ====================================
•10 INPUT"ENTER TWO STRINGS";A$,B$
•20 DIM A(255),B(255)
•30 FOR J=1 TO LEN(A$)
•40 X=ASC(MID$(A$,J,1)) : A(X)=A(X)+1
•50 NEXT J
•60 FOR J=1 TO LEN(B$)
•70 X=ASC(MID$(B$,J,1)) : B(X)=B(X)+1
•80 NEXT J
•90 IS$="DOES"
•100 FOR J=0 TO 255
•110 IF A(J)>B(J) THEN IS$="DOES NOT"
•120 NEXT J
•130 PRINT"[DOWN][DOWN]THE SECOND STRING
 ";IS$;" CONTAIN"
•140 PRINT"THE LETTERS OF THE FIRST STRIN
 G."
```

David used a "hashing" technique in which arrays store the number of occurrences of each character in each string. For example, the ASCII value of "C" is 67. If there are two C's in A$ and only one C in B$, then A(67) equals 2 and B(67) is 1. The loop at line 100 merely compares each element in A( ) with B( ) to make sure that B$ contains at least as many occurrences of each character as A$ does. The output message IS$ is changed if some element of B( ) is less than the corresponding element of A( ).

Finally *Problem #44:4 Key Functions* asked for your favorite function key definitions. The listing below shows how some readers make their lives easier.

```
•1 REM ====================================
•2 REM   COMMODARES PROBLEM #44-4:
•3 REM     KEY FUNCTIONS
•6 REM =========  C-128 ONLY  ===========
•10 REM ---- JIM SPEERS -----------------
•20 KEY 5,CHR$(27)+"QDSAVE"+CHR$(34)
•30 KEY 7,"LIST[5" "]-4[3"9"][9"[LEFT]"]"
•40 KEY 1,"X%=A/256:B%=A-256*X%:PRINTB%;X
 %"+CHR$(13)
•50 KEY 3,"X=A:FORI=3TO0STEP-1:B=INT(X/(1
 6[UPARROW]I)):PRINTCHR$(48+B-7*(B>9));:X
 =X-B*16[UPARROW]I:NEXT"+CHR$(13)
•60 KEY 5,"X=(A>32767):PRINTCHR$(48-X);:B
 =A+32768*X:FORI=14TO0STEP-1:PRINTMID$(ST
 R$(-((BAND(2[UPARROW]I))=(2[UPARROW]I[3"
 )"],2,1);:NEXT"+CHR$(13)
•100 REM---- WALLACE LEEKER -------------
 ---
•110 C$=CHR$(13):KEY1,".12"+C$:KEY2,".25"
 +C$:KEY3,".37"+C$:KEY4,".50"+C$:KEY5,".6
 2"+C$:KEY6,".75"+C$:KEY7,".87"+C$
•200 REM---- JOHN LOCKE ----------------
 ---
•210 R$=CHR$(13):Q$=CHR$(34):E$=CHR$(27)
•220 KEY1,"[CLEAR][HOME][HOME]DIRECTORY:"
 +E$+"R"+R$
•230 KEY7,E$+"I"+"RUN:"+R$
•240 KEY2,"DLOAD[3"[009]"]"+E$+"@"+R$
•250 KEY6,"[INSERT][INSERT]SCRATCH[3"[009
 ]"]:"+E$+"@"+R$+"Y"+R$
•260 KEY3,"[HOME][5"[009]"]"+E$+"T[DOWN]D
 IRECTORY"+R$
•270 KEY4,E$+" CLOSE4:OPEN4:CMD4:LIST"+R$
 +"PRINT#4,7:CLOSE4"+R$
```

You cannot run this program as listed. The computer stops

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with an "Out of Memory" error since there are too many characters assigned to the function keys. Although this program is only for the C-128, the C-64 can certainly implement many of these ideas. Various function key utilities exist for the C-64, including at least one from the pages of *Ahoy!*

Jim Speers sent several of his most useful definitions. Line 20 erases to the end of the line (Escape Q) then prints DSAVE and a quotation mark. Jim occasionally redefines key 7 as shown in line 30. This lets him type in a starting line number and then lists the program up to the line where his DATA statements begin, or where his current subroutine ends.

Jim also sent along some handy binary/hexadecimal conversion routines in lines 40 through 60. First define the variable A to be a decimal integer from 0 to 65535. For example, type A=32000: then press F1 to see 32000 represented in decimal low byte/high byte format. Press F3 to see the hexadecimal representation of A, or press F5 to see the binary equivalent of A.

Wallace Leeker (Lemay, MO) sent the function key arrangement he uses with a stock-charting program he wrote. He must enter the High, Low, and Close values of the stock he is following, and those numbers are given in fractional form as eighths are already marked on the function keys. Of course you could make the values more accurate if desired. Perhaps you can think of other function key conversions that are useful.

John Locke (Central Point, OR) sent some very interesting function key definitions. Line 210 sets up some constants, namely the carriage return, quotation mark, and escape. Line 220 gives a directory listing in reverse video. Escape R reverses screen colors. (Escape N restores them to normal.)

The Escape I in line 230 scrolls everything from the cursor line down and leaves the cursor at the beginning of a blank line. Then RUN is typed and entered. Not having to move the cursor around to find a blank line is an advantage for most function key definitions.

Line 240 is a "load from directory" command. With the directory on the screen, position the cursor in front of the program to be loaded and press F2. The cursor is tabbed past the filename. The Escape @ clears everything from the cursor to the bottom of the display, and the selected program is loaded.

John defines F6 as a "fast scratch from the directory" key. Move the cursor to the directory display in front of the program to be scratched and press F6. You'd better be sure of what you are doing, because in the blink of an eye, the program will be gone. The two Inserts make room for "SCRATCH" ahead of the filename. The cursor is tabbed past the filename and the rest of the screen is cleared with the Escape @. The "Y" is an automatic response to the "Are You Sure?" query. Handy if you are sure of what you're doing. Better keep an "Unscratch" program close by just in case.

A very interesting definition is given for F3 in line 260. This key creates a second directory listing on the right side of the screen. The cursor is tabbed over. The Escape T defines the cursor position to be the top left corner of the current screen window, and the Directory command is given. On my C-128 this definition did not work without the cursor-down after the Escape T command. John did not have a cursor-down in his definition, so I wonder if we have different ROM versions. Any input on this?

The final definition is probably the most essential. I often wonder why Commodore BASIC does not include an LLIST command to send listings to the printer. Anyway, John's definition for F4 fills the bill, including the proper "Unlisten" command (PRINT#4,7) and the closing of the printer file.

Thanks to Norris Price (APO SF) for the nice, complimentary letter and the *Commodares* solution. He asked why I have never "plugged" *Simons' BASIC* like I have COMAL. First, I have never used either of these languages, although both of them have significant advantages over BASIC 2.0 and some advantages over BASIC 7.0.

The listings in this column are representative of the solutions readers send. To my knowledge, no one has ever sent a solution written in *Simons' BASIC*. I am (and I presume the readers of this column are) interested in different programming concepts and languages. If you write in *Simons' BASIC* and like it, let me know. One of the best ways to show off a language is to send a *Commodares* challenge that is very easy in your language but difficult in standard BASIC.

That's it for this month. Keep those challenges and solutions coming. We will make the challenges as tough or as easy as you want them. See you next month. □

PROGRAM LISTINGS

Attention new *Ahoy!* readers! You must read the following information very carefully prior to typing in programs listed in *Ahoy!* Certain Commodore characters, commands, and strings of characters and commands will appear in a special format. Follow the instructions and listings guide on this page.

On the following pages you'll find several programs that you can enter on your Commodore computer. But before doing so, read this entire page carefully.

To insure clear reproductions, *Ahoy!'s* program listings are generated on a daisy wheel printer, incapable of printing the commands and graphic characters used in Commodore programs. These are therefore represented by various codes enclosed in brackets [ ]. For example: the SHIFT CLR/HOME command is represented onscreen by a heart . The code we use in our listings is [CLEAR]. The chart below lists all such codes which you'll encounter in our listings, except for one other special case.

The other special case is the COMMODORE and SHIFT characters. On the front of most keys are two symbols. The symbol on the left is obtained by pressing that key while holding down the COMMODORE key; the symbol on the right, by pressing that key while holding down the SHIFT key. COMMODORE and SHIFT characters are represented in our listings by a lower-case "s" or "c" followed by the symbol of the key you must hit. COMMODORE J, for example, is represented by [c J], and SHIFT J by [s J].

Additionally, any character that occurs more than two times in a row will be displayed by a coded listing. For example, [3 "[LEFT]"] would be 3 CuRSoR left commands in a row, [5 "[s EP]"] would be 5 SHIFTed English Pounds, and so on. Multiple blank spaces will be noted in similar fashion: e.g., 22 spaces as [22 " "].

Sometimes you'll find a program line that's too long for the computer to accept (C-64 lines are a maximum of 80 characters, or 2 screen lines long; C-128 lines, a maximum of 160 characters, 2 or 4 screen lines in 40 or 80 columns respectively). To enter these lines, refer to the *BASIC Command Abbreviations Appendix* in your User Manual.

On the next page you'll find our *Bug Repellent* programs for the C-128 and C-64. The version for your machine will help you proofread programs after typing them. (Please note: the *Bug Repellent* line codes that follow each program line, in the whited-out area, should *not* be typed in. See instructions preceding each program.)

On the second page following you will find *Flankspeed*, our ML entry program, and instructions on its use.

Call *Ahoy!* at 212-239-6089 with any problems (if busy or no answer after three rings, call 212-239-0855).

WHEN YOU SEE	IT MEANS	YOU TYPE	YOU WILL SEE	WHEN YOU SEE	IT MEANS	YOU TYPE	YOU WILL SEE
[CLEAR]	Screen Clear	SHIFT CLR/HOME		[BLACK]	Black	CNTRL 1	
[HOME]	Home	CLR/HOME		[WHITE]	White	CNTRL 2	
[UP]	Cursor Up	SHIFT ↑ CRSR ↓		[RED]	Red	CNTRL 3	
[DOWN]	Cursor Down	↑ CRSR ↓		[CYAN]	Cyan	CNTRL 4	
[LEFT]	Cursor Left	SHIFT ← CRSR →		[PURPLE]	Purple	CNTRL 5	
[RIGHT]	Cursor Right	← CRSR →		[GREEN]	Green	CNTRL 6	
[SS]	Shifted Space	SHIFT Space		[BLUE]	Blue	CNTRL 7	
[INSERT]	Insert	SHIFT INST/DEL		[YELLOW]	Yellow	CNTRL 8	
[DEL]	Delete	INST/DEL		[F1]	Function 1	F1	
[RVSON]	Reverse On	CNTRL 9		[F2]	Function 2	SHIFT F1	
[RVSOFF]	Reverse Off	CNTRL 0		[F3]	Function 3	F3	
[UPARROW]	Up Arrow	↑	↑	[F4]	Function 4	SHIFT F3	
[BACKARROW]	Back Arrow	←	←	[F5]	Function 5	F5	
[PI]	PI	π	π	[F6]	Function 6	SHIFT F5	
[EP]	English Pound	£	£	[F7]	Function 7	F7	
				[F8]	Function 8	SHIFT F7	

BUG REPELLENT FOR THE 64 & 128 By BUCK CHILDRESS

Please note: the *Bug Repellent* programs listed here are for *Ahoy!* programs published from the May 1987 issue onward! For older programs, use the older version.

Type in, save, and run *Bug Repellent.* You'll be asked if you want automatic saves to take place. If so, you're prompted for the device, DISK (D) or TAPE (T). You then pick a starting file number, 0 through 99. Next, you enter a name, up to 14 characters long. At this point, *Bug Repellent* verifies your entries and gives you a chance to change them if you want. If no changes are needed, *Bug Repellent* activates itself. (Pressing RETURN without answering the prompts defaults to disk drive and begins your files with "00BACKUP".)

Type NEW and begin entering an *Ahoy!* program. As you enter program lines and press RETURN, a *Bug Repellent* code appears at the top of your screen. If it doesn't match the code in the program listing, an error exists. Correct the line and the codes will match.

If used, automatic saves take place every 15 minutes. When the RETURN key is pressed on a program line, the screen changes color to let you know that a save will begin in about three seconds. You may cancel the save by pressing the RUN STOP key. The file number increments after each save. It resets to 00 if 99 is surpassed. After saving, or cancelling, the screen returns to its original color and the timer resets for 15 minutes.

When you've finished using *Bug Repellent*, deactivate it by typing SYS 49152 [RETURN] for the Commodore 64 or SYS 4864 [RETURN] for the Commodore 128.

C-64 BUG REPELLENT

```
•10 PRINTCHR$(147)"LOADING AND CHECKING THE DATA[3"."]":J
=49152
•20 FORB=0TO11:READA:IFA<0ORA>255THEN40
•30 POKEJ+B,A:X=X+A:NEXTB:READA:IFA=XTHEN50
•40 PRINT:PRINT"ERROR IN DATA LINE:"PEEK(64)*256+PEEK(63)
:END
•50 X=0:J=J+12:IFJ<49456THEN20
•60 POKE198,0:POKE49456,0:A$="Y":B$=A$:C$="D":D$="DISK":D
=8:PRINTCHR$(147)
•70 INPUT"DO YOU WANT AUTOMATIC SAVES (Y/N)";A$:PRINT:IFA
$="Y"THEN90
•80 PRINT"NO AUTOMATIC SAVES[3"."]":GOTO150
•90 POKE49456,1:INPUT"DISK OR TAPE (D/T)";C$:IFC$<>"D"THE
ND=1:D$="TAPE"
•100 POKE49457,D:D$=D$+" DRIVE":PRINT:INPUT"FILE NUMBER (
0-99)";N
•110 N$=RIGHT$(STR$(N),2):IFN<10THENN$=CHR$(48)+CHR$(N+48
)
•120 F$="BACKUP":PRINT:INPUT"FILENAME";F$:F$=N$+LEFT$(F$,
14):L=LEN(F$)
•130 POKE49458,L:FORJ=1TOL:POKE49458+J,ASC(MID$(F$,J,1)):
NEXTJ:PRINT
•140 PRINT"SAVING DEVICE ** "D$:PRINT"STARTING WITH ** "F
$
•150 PRINT:INPUT"IS THIS CORRECT (Y/N)";B$:IFB$<>"Y"THEN6
0
•160 POKE770,131:POKE771,164:SYS49152:END
•170 DATA169,79,32,210,255,162,38,160,192,204,3,3,1507
•180 DATA208,10,162,131,160,164,169,70,32,210,255,44,1615
•190 DATA169,78,32,210,255,142,2,3,140,3,3,76,1113
•200 DATA36,193,32,96,165,134,122,132,123,32,115,0,1180
•210 DATA170,240,243,162,255,134,58,144,3,76,150,164,1799
•220 DATA32,107,169,32,121,165,173,0,2,240,5,169,1215
•230 DATA79,141,2,3,76,162,164,169,0,133,2,133,1064
•240 DATA251,133,252,133,254,24,101,20,69,254,230,254,197
5
•250 DATA24,101,21,69,254,170,230,254,164,252,185,0,1724
•260 DATA2,133,253,201,34,208,6,165,2,73,255,133,1465
•270 DATA2,201,32,208,4,165,2,240,8,138,24,101,1125
•280 DATA253,69,254,170,44,198,254,230,252,164,253,208,23
49
•290 DATA213,138,41,240,74,74,74,74,24,105,129,141,1327
•300 DATA44,193,138,41,15,24,105,129,141,45,193,162,1230
•310 DATA0,189,43,193,240,12,157,0,4,173,134,2,1147
•320 DATA157,0,216,232,208,239,169,38,141,2,3,173,1578
•330 DATA48,193,240,23,165,161,201,212,176,4,165,160,1748
•340 DATA240,13,238,32,208,160,0,32,225,255,208,6,1617
•350 DATA32,33,193,76,38,192,232,208,242,200,208,239,1893
•360 DATA32,68,229,169,0,168,174,49,193,32,186,255,1555
•370 DATA173,50,193,162,51,160,193,32,189,255,169,43,1670
•380 DATA166,45,164,46,32,216,255,162,1,189,51,193,1520
•390 DATA168,200,152,201,58,144,2,169,48,157,51,193,1543
•400 DATA201,48,208,3,202,16,234,32,33,193,76,116,1362
•410 DATA164,206,32,208,169,0,170,168,76,219,255,160,1827
•420 DATA1,1,160,0,0,65,72,79,89,33,0,0,500
```

C-128 BUG REPELLENT

```
•10 PRINTCHR$(147)"LOADING AND CHECKING THE DATA[3"."]":J
=4864
•20 FORB=0TO11:READA:IFA<0ORA>255THEN40
•30 POKEJ+B,A:X=X+A:NEXTB:READA:IFA=XTHEN50
•40 PRINT:PRINT"ERROR IN DATA LINE:"PEEK(66)*256+PEEK(65)
:END
•50 X=0:J=J+12:IFJ<5213THEN20
•60 POKE208,0:POKE5213,0:A$="Y":B$=A$:C$="D":D$="DISK":D=
8:PRINTCHR$(147)
•70 INPUT"DO YOU WANT AUTOMATIC SAVES (Y/N)";A$:PRINT:IFA
$="Y"THEN90
•80 PRINT"NO AUTOMATIC SAVES[3"."]":GOTO150
•90 POKE5213,1:INPUT"DISK OR TAPE (D/T)";C$:IFC$<>"D"THEN
D=1:D$="TAPE"
•100 POKE5214,D:D$=D$+" DRIVE":PRINT:INPUT"FILE NUMBER (0
-99)";N
•110 N$=RIGHT$(STR$(N),2):IFN<10THENN$=CHR$(48)+CHR$(N+48
)
•120 F$="BACKUP":PRINT:INPUT"FILENAME";F$:F$=N$+LEFT$(F$,
14):L=LEN(F$)
•130 POKE5215,L:FORJ=1TOL:POKE5215+J,ASC(MID$(F$,J,1)):NE
XTJ:PRINT
•140 PRINT"SAVING DEVICE ** "D$:PRINT"STARTING WITH ** "F
$
•150 PRINT:INPUT"IS THIS CORRECT (Y/N)";B$:IFB$<>"Y"THEN6
0
•160 POKE770,198:POKE771,77:SYS4864:END
•170 DATA32,58,20,169,41,162,19,236,3,3,208,4,955
•180 DATA169,198,162,77,141,2,3,142,3,3,224,19,1143
•190 DATA208,7,32,125,255,79,78,0,96,32,125,255,1292
•200 DATA79,70,70,0,96,162,0,134,251,189,0,2,1053
•210 DATA240,19,201,48,144,9,201,58,176,5,133,251,1485
•220 DATA232,208,238,134,252,165,251,208,3,76,198,77,2042
•230 DATA169,0,166,235,164,236,133,253,133,254,142,47,193
2
•240 DATA20,140,48,20,24,101,22,69,254,230,254,24,1206
•250 DATA101,23,69,254,170,230,254,164,252,185,0,2,1704
•260 DATA133,251,201,34,208,6,165,253,73,255,133,253,1965
•270 DATA201,32,208,4,165,253,240,8,138,24,101,251,1625
•280 DATA69,254,170,44,198,254,230,252,164,251,208,213,23
07
•290 DATA138,41,240,74,74,74,74,24,105,65,141,88,1138
•300 DATA20,138,41,15,24,105,65,141,89,20,32,79,769
•310 DATA20,189,85,20,240,6,32,210,255,232,208,245,1742
•320 DATA174,47,20,172,48,20,24,32,240,255,173,93,1298
•330 DATA20,240,27,165,161,201,212,176,4,165,160,240,1771
•340 DATA17,32,65,20,238,32,208,238,1,214,32,225,1322
•350 DATA255,208,6,32,49,20,76,198,77,232,208,242,1603
•360 DATA200,208,239,32,66,193,173,95,20,162,96,160,1644
•370 DATA20,32,189,255,169,0,170,32,104,255,169,0,1395
•380 DATA174,94,20,168,32,186,255,169,45,174,16,18,1351
•390 DATA172,17,18,32,216,255,162,1,189,96,20,168,1346
•400 DATA200,152,201,58,144,2,169,48,157,96,20,201,1448
•410 DATA48,208,3,202,16,234,32,49,20,141,0,2,955
•420 DATA76,183,77,58,59,32,65,20,206,32,208,206,1222
•430 DATA1,214,169,0,170,168,76,219,255,32,79,20,1403
•440 DATA169,26,141,0,214,173,0,214,16,251,96,162,1462
•450 DATA0,142,0,255,96,19,18,32,32,32,32,146,804
•460 DATA0,1,0,0,65,72,79,89,33,0,0,0,339
```

FLANKSPEED FOR THE C-64 By GORDON F. WHEAT

Flankspeed will allow you to enter machine language *Ahoy!* programs without any mistakes. Once you have typed the program in, save it for future use. While entering an ML program with *Flankspeed* there is no need to enter spaces or hit the carriage return. This is all done automatically. If you make an error in a line a bell will ring and you will be asked to enter it again. To LOAD in a program Saved with *Flankspeed* use LOAD "name",1,1 for tape, or LOAD "name",8,1 for disk. The function keys may be used after the starting and ending addresses have been entered.

f1–SAVEs what you have entered so far.

f3–LOADs in a program worked on previously.

f5–To continue on a line you stopped on after LOADing in the previous saved work.

f7–Scans through the program to locate a particular line, or to find out where you stopped the last time you entered the program. It temporarily freezes the output as well.

```
100 POKE53280,12:POKE53281,11                                 OP
105 PRINT"[CLEAR][c 8][RVSON][15" "]FLANKSPEED[15" "]";       FP
110 PRINT"[RVSON][5" "]MISTAKEPROOF ML ENTRY PROGRAM[6" "
]"                                                            JP
115 PRINT"[RVSON][9" "]CREATED BY G. F. WHEAT[9" "]"          FA
120 PRINT"[RVSON][3" "]COPR. 1987, ION INTERNATIONAL INC.
[3" "]"                                                       AJ
125 FORA=54272TO54296:POKEA,0:NEXT                            ND
130 POKE54272,4:POKE54273,48:POKE54277,0:POKE54278,249:PO
KE54296,15                                                    NP
135 FORA=680TO699:READB:POKEA,B:NEXT                          FL
140 DATA169,251,166,253,164,254,32,216,255,96                 FF
145 DATA169,0,166,251,164,252,32,213,255,96                   EK
150 B$="STARTING ADDRESS IN HEX":GOSUB430:AD=B:SR=B           KP
155 GOSUB480:IFB=0THEN150                                     OE
160 POKE251,T(4)+T(3)*16:POKE252,T(2)+T(1)*16                 AM
165 B$="ENDING ADDRESS IN HEX":GOSUB430:EN=B                  PE
170 GOSUB470:IFB=0THEN150                                     PG
175 POKE254,T(2)+T(1)*16:B=T(4)+1+T(3)*16                     GM
180 IFB>255THENB=B-255:POKE254,PEEK(254)+1                    HG
185 POKE253,B:PRINT                                           EC
190 REM  GET HEX LINE                                         ED
195 GOSUB495:PRINT": [c P][LEFT]";:FORA=0TO8                  KD
200 FORB=0TO1:GOTO250                                         IH
205 NEXTB                                                     IJ
210 A%(A)=T(1)+T(0)*16:IFAD+A-1=ENTHEN340                     FA
215 PRINT" [c P][LEFT]";                                      EG
220 NEXTA:T=AD-(INT(AD/256)*256):PRINT" "                     II
225 FORA=0TO7:T=T+A%(A):IFT>255THENT=T-255                    GL
230 NEXT                                                      GI
235 IFA%(8)<>TTHENGOSUB375:GOTO195                            FL
240 FORA=0TO7:POKEAD+A,A%(A):NEXT:AD=AD+8:GOTO195             IM
245 REM    GET HEX INPUT                                      PA
250 GETA$:IFA$=""THEN250                                      GA
255 IFA$=CHR$(20)THEN305                                      GO
260 IFA$=CHR$(133)THEN535                                     LM
265 IFA$=CHR$(134)THEN560                                     IG
270 IFA$=CHR$(135)THENPRINT" ":GOTO620                        HO
275 IFA$=CHR$(136)THENPRINT" ":GOTO635                        HE
280 IFA$>"@"ANDA$<"G"THENT(B)=ASC(A$)-55:GOTO295              MI
285 IFA$>"/"ANDA$<":"THENT(B)=ASC(A$)-48:GOTO295              DJ
290 GOSUB415:GOTO250                                          JA
295 PRINTA$"[c P][LEFT]";                                     PK
300 GOTO205                                                   FA
305 IFA>0THEN320                                              BI
310 A=-1:IFB=1THEN330                                         BB
315 GOTO220                                                   FA
320 IFB=0THENPRINTCHR$(20);CHR$(20);:A=A-1                    BF
325 A=A-1                                                     FK
330 PRINTCHR$(20);:GOTO220                                    PH
335 REM LAST LINE                                             CP
340 PRINT" ":T=AD-(INT(AD/256)*256)                           KH
345 FORB=0TOA-1:T=T+A%(B):IFT>255THENT=T-255                  OD
350 NEXT                                                      OB
355 IFA%(A)<>TTHENGOSUB375:GOTO195                            LH
360 FORB=0TOA-1:POKEAD+B,A%(B):NEXT                           BO
365 PRINT:PRINT"YOU ARE FINISHED!":GOTO535                    MB
370 REM BELL AND ERROR MESSAGES                               LM
375 PRINT:PRINT"LINE ENTERED INCORRECTLY":PRINT:GOTO415       JK
380 PRINT:PRINT"INPUT A 4 DIGIT HEX VALUE!":GOTO415           PG
385 PRINT:PRINT"ENDING IS LESS THAN STARTING!":B=0:GOTO41
5                                                             IK
390 PRINT:PRINT"ADDRESS NOT WITHIN SPECIFIED RANGE!":B=0:
GOTO415                                                       HK
395 PRINT:PRINT"NOT ZERO PAGE OR ROM!":B=0:GOTO415            DM
400 PRINT"?ERROR IN SAVE":GOTO415                             JK
405 PRINT"?ERROR IN LOAD":GOTO415                             IO
410 PRINT:PRINT:PRINT"END OF ML AREA":PRINT                   JO
415 POKE54276,17:POKE54276,16:RETURN                          BF
420 OPEN15,8,15:INPUT#15,A,A$:CLOSE15:PRINTA$:RETURN          DH
425 REM GET FOUR DIGIT HEX                                    IM
430 PRINT:PRINTB$;:INPUTT$                                    OL
435 IFLEN(T$)<>4THENGOSUB380:GOTO430                          JD
440 FORA=1TO4:A$=MID$(T$,A,1):GOSUB450:IFT(A)=16THENGOSUB
380:GOTO430                                                   AK
445 NEXT:B=(T(1)*4096)+(T(2)*256)+(T(3)*16)+T(4):RETURN       KB
450 IFA$>"@"ANDA$<"G"THENT(A)=ASC(A$)-55:RETURN               GM
455 IFA$>"/"ANDA$<":"THENT(A)=ASC(A$)-48:RETURN               NJ
460 T(A)=16:RETURN                                            IC
465 REM ADDRESS CHECK                                         OL
470 IFAD>ENTHEN385                                            HO
475 IFB<SRORB>ENTHEN390                                       LE
480 IFB<256OR(B>40960ANDB<49152)ORB>53247THEN395              OB
485 RETURN                                                    HE
490 REM ADDRESS TO HEX                                        PM
495 AC=AD:A=4096:GOSUB520                                     AP
500 A=256:GOSUB520                                            NF
505 A=16:GOSUB520                                             LG
510 A=1:GOSUB520                                              HE
515 RETURN                                                    JD
520 T=INT(AC/A):IFT>9THENA$=CHR$(T+55):GOTO530                OC
525 A$=CHR$(T+48)                                             JI
530 PRINTA$;:AC=AC-A*T:RETURN                                 AA
535 A$="**SAVE**":GOSUB585                                    IC
540 OPEN1,T,1,A$:SYS680:CLOSE1                                AB
545 IFST=0THENEND                                             FB
550 GOSUB400:IFT=8THENGOSUB420                                PM
555 GOTO535                                                   FI
560 A$="**LOAD**":GOSUB585                                    PE
565 OPEN1,T,0,A$:SYS690:CLOSE1                                PO
570 IFST=64THEN195                                            OI
575 GOSUB405:IFT=8THENGOSUB420                                CO
580 GOTO560                                                   GN
585 PRINT" ":PRINTTAB(14)A$                                   KA
590 PRINT:A$="":INPUT"FILENAME";A$                            IO
595 IFA$=""THEN590                                            HK
600 PRINT:PRINT"TAPE OR DISK?":PRINT                          HL
605 GETB$:T=1:IFB$="D"THENT=8:A$="@0:"+A$:RETURN              NP
610 IFB$<>"T"THEN605                                          KO
615 RETURN                                                    PH
620 B$="CONTINUE FROM ADDRESS":GOSUB430:AD=B                  DD
625 GOSUB475:IFB=0THEN620                                     NK
630 PRINT:GOTO195                                             HN
635 B$="BEGIN SCAN AT ADDRESS":GOSUB430:AD=B                  FK
640 GOSUB475:IFB=0THEN635                                     LN
645 PRINT:GOTO670                                             HI
650 FORB=0TO7:AC=PEEK(AD+B):GOSUB505:IFAD+B=ENTHENAD=SR:G
OSUB410:GOTO195                                               LM
655 PRINT" ";:NEXTB                                           LE
660 PRINT:AD=AD+8                                             CD
665 GETB$:IFB$=CHR$(136)THEN195                               JD
670 GOSUB495:PRINT": ";:GOTO650                               KE
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 87 and 88 explain these codes and provide other essential information on entering ***Ahoy!*** programs. Refer to these pages **before** entering any programs!

PIZZA BOY
FROM PAGE 22

```
•10 COLOR.,1:COLOR4,1:GRAPHIC1,1:GRAPHIC.
:PRINTCHR$(147)CHR$(11)CHR$(142)          HB
•20 PRINT"[5"[DOWN]"]"TAB(6)"[c 1]PLEASE
WAIT[3"."]LOADING DATA":RESTORE760:FORX=
3584TO3584+7*64:READA$:POKEX,DEC(A$):NEX
T:FORX=4032TO4032+45:POKEX,.:NEXT         CG
•30 FORX=4077TO4077+18:POKEX,255:NEXT:GOS
UB950:PRINTTAB(16)"[3"[DOWN]"]OKAY!!"     FH
•40 SLEEP2:POKE53248+21,.:PRINT"[CLEAR][c
 1][DOWN]"TAB(7)"[s U][23"[s C]"][s I]"   EO
•50 PRINTTAB(7)"[s B] [RED][RVSON][c A][s
 C][s C][c S][RVSOFF] [RVSON][s B][RVSOF
F] [RVSON][4"[s C]"][RVSOFF] [RVSON][4"[
s C]"][RVSOFF] [RVSON][sEP][s C][s C][c
*][RVSOFF] [c 1][s B]"                    ME
•60 PRINTTAB(7)"[s B] [RED][RVSON][s B][R
VSOFF]  [RVSON][s B][RVSOFF] [RVSON][s B
][RVSOFF][3" "][RVSON][sEP][RVSOFF][sEP]
[3" "][RVSON][sEP][RVSOFF][sEP] [RVSON][
s B][RVSOFF]  [RVSON][s B][RVSOFF] [c 1]
[s B]"                                    LM
•70 PRINTTAB(7)"[s B] [RED][RVSON][c Q][s
 C][s C][c X][RVSOFF] [RVSON][s B][RVSOF
F]  [RVSON][sEP][RVSOFF][sEP][3" "][RVSO
N][sEP][RVSOFF][sEP]  [RVSON][c Q][s C][
s C][c W][RVSOFF] [c 1][s B]"             BM
•80 PRINTTAB(7)"[s B] [RED][RVSON][s B][R
VSOFF][4" "][RVSON][s B][RVSOFF] [RVSON]
[sEP][RVSOFF][sEP][3" "][RVSON][sEP][RVS
OFF][sEP][3" "][RVSON][s B][RVSOFF]  [RV
SON][s B][RVSOFF] [c 1][s B]"             KN
•90 PRINTTAB(7)"[s B] [RED][RVSON][s B][R
VSOFF][4" "][RVSON][s B][RVSOFF] [RVSON]
[4"[s C]"][RVSOFF] [RVSON][4"[s C]"][RVS
OFF] [RVSON][s B][RVSOFF]  [RVSON][s B][
RVSOFF] [c 1][s B]"                       ID
•100 PRINTTAB(7)"[s B][23"[s S]"][s B]"   IO
•110 PRINTTAB(7)"[s B][YELLOW][7"[s C]"][
c 3][RVSON][c D][c F][RVSOFF][c K][RVSON
][c D][c F][RVSOFF][c *][RVSON][c *][sEP
][RVSOFF][sEP][YELLOW][7"[s C]"][c 1][s
B]"                                       DA
•120 PRINTTAB(7)"[s B][RED][7"[s C]"][c 3
][RVSON][c C][c V][RVSOFF][c V][c K][RVS
ON][c K][RVSOFF] [c *][sEP] [RED][7"[s C
]"][c 1][s B]"                            FK
•130 PRINTTAB(7)"[s B][YELLOW][7"[s C]"][
c 3][RVSON][c D][c F][RVSOFF][c K][c K][
RVSON][c K][RVSOFF] [c M][c H] [YELLOW][
7"[s C]"][c 1][s B]"                      BL
•140 PRINTTAB(7)"[s B][RED][7"[s C]"][c 3
][RVSON][c C][c V][RVSOFF][c K][RVSON][c
C][c V][RVSOFF] [c M][c H] [RED][7"[s C
]"][c 1][s B]"                            DK
•150 PRINTTAB(7)"[s J][23"[s C]"][s K]"   FJ
•160 VOL15:TEMPO10                        IO
•170 PRINTTAB(10)"[DOWN][DOWN]A GAME FOR
THE C-128":PRINTTAB(14)"[DOWN][RED][s W]
 [s X] [c 1]BY [RED][s X] [s W]":PRINTTA
B(9)"[DOWN][c 1]CLEVELAND M. BLAKEMORE"   OC
•180 RESTORE730:READA$,B$:PLAYA$:PLAYB$   MJ
•190 CHAR.,10,21,"[c 8]JOYSTICK IN PORT T
WO":CHAR.,7,23,"[c 3]PRESS FIRE BUTTON T
O BEGIN"                                  PA
•200 X=1:DO:COLOR5,RND(.)*15+2:X=X+1+(X=4
)*4:CHAR.,8,7+X,"[7"[s C]"][9"[RIGHT]"][
7"[s C]"]":LOOPUNTILJOY(2)>127:GOSUB410   CC
•210 REM INITIALIZE VARIABLES             NJ
•220 CLR:DIM J,X,Y,C,U,M,T,H,I,K,F,P,B,Z,
W,V,C(6),X(7),Y(7),L,PB,CS,F$,M$,E$       DK
•230 P=2040:B=56:I=.005:Z=.:U=1:M=2:T=3:K
=129:W=65:PB=3:V=53248:F$="[3"#"].##":PU
DEF"0":E$="GAME"+CHR$(160)+"OVER"         DA
•240 RESTORE610:FORJ=.TO6:READC(J):NEXT:F
ORJ=.TO7:READX(J),Y(J):NEXT               KI
•250 SPRITE1,.,11,.,.,.,.,.:SPRITE2,.,10,.,
.,.,.,.:FORJ=1TO8:READX,Y:MOVSPRJ,X,Y:NEXT
:FORJ=.TO7:READX:POKE2040+J,X:NEXT:FORJ=
3TO6:SPRITEJ,.,J,.,.,.,.,.:NEXT           HE
•260 SPRITE7,.,3,.,.,.,.,.:SPRITE8,.,1,1,.,
.,.,.:FORJ=2TO6:READX:MOVSPRJ,X#1:NEXT:REA
DM$:CHAR.,3,3,"[c 8][RVSOFF][s X] [s X]
[s X]":PRINT"[HOME][DOWN][RIGHT][RIGHT][
WHITE]$";:PRINTUSINGF$;CS:GOSUB360        LJ
•270 FORJ=.TO10:C=BUMP(U):C=BUMP(U):C=BUM
P(M):C=BUMP(M):NEXT:POKEV+21,255          FE
•280 REM MAIN LOOP                        AL
•290 DO:X=RSPPOS(U,.):Y=RSPPOS(U,U):A=JOY
(M):J=AAND15:IFJTHENMOVSPRU,T;(J-U)*45:P
OKEP,B+Z:SOUNDU,P,U,.,.,T                 GO
•300 IFAANDJ=.ANDC=KANDF=.THENPRINT"[HOME
][6"[DOWN]"][4"[RIGHT]"] ":F=U:I=.009:SO
UNDM,P,M,.,.,U                            GP
•310 Z=(Z=.)*-U:H=H-I:SPRITEU,,C(H):C=BUM
P(M):IF(CANDU)THENMOVSPRU,X,Y             OC
•320 C=BUMP(U):LOOPUNTIL((CANDU)ANDC<>K)O
RH<U:IFC=WANDF=.THEN290                   OI
•330 IFC=WTHENSPRITE7,.:F=.:L=L+U:PLAYM$:
CS=CS+40*(H*.1):PRINT"[HOME][DOWN][3"[RI
GHT]"][WHITE]";:PRINTUSINGF$;CS:GOSUB360
:ON(L=5ORL=10ORL=15)*-UGOSUB390:GOTO270   HF
•340 POKEP,B+5:SOUNDU,P,5,.,100,100,M:SOU
NDM,P,10,.,600,150,M,220:FORY=.TO10:FORJ
=UTO16:SPRITEU,U,J:NEXT:NEXT:SPRITEU,.:C
HAR.,U+PB*M,T," ":PB=PB-U                 HL
•350 IFPBTHENPOKEP,B:MOVSPRU,60,93:F=.:PR
INT"[HOME][6"[DOWN]"][4"[RIGHT]"] ":SLEE
P1:GOSUB360:GOTO270:ELSEFORJ=.TO99:COLOR
```

```
5,RND(U)*15+M:PRINT"[HOME][3"[DOWN]"][RI
GHT][RVSON]";E$:NEXT:PLAYM$:RUN40          KG
•360 J=RND(U)*8:MOVSPR7,X(J),Y(J):SPRITE7
,U:F=.:FORJ=.TO3:SOUNDU,223,48,,,,M,75:S
LEEP1:NEXT:SOUNDU,30000,40,U,,10000,M      EH
•370 FORJ=.TO12:PRINT"[HOME][6"[DOWN]"][R
IGHT][RIGHT] ":FORX=.TO10:NEXT:PRINT"[HO
ME][6"[DOWN]"][RIGHT][RIGHT][GREEN][s V]
":FORX=.TO10:NEXT:NEXT                     GD
•380 FORJ=.TO9:PRINT"[HOME][6"[DOWN]"][RI
GHT][c 5][s W]":FORX=.TO30:NEXT:SOUNDU,5
00+RND(U)*500,5,.,,,3:PRINT"[HOME][6"[DO
WN]"][RIGHT][s Q]":FORX=.TO30:NEXT:NEXT:
PRINT"[HOME][6"[DOWN]"][4"[RIGHT]"][c 1]
[s S]":H=6:I=.005:RETURN                   EN
•390 RESTORE690:FORJ=MTO6:READX:MOVSPRJ,X
#(RSPPOS(J,M)+(JANDU)):NEXT:RETURN         BI
•400 REM GAME SCREEN                       AL
•410 PRINTCHR$(27)CHR$(77)"[CLEAR][RED][R
VSON] PIZZA BOY [BLACK][5" "][c 2][9"[s
+]"][BLACK][5" "][c 4][10"[s +]"]";        GG
•420 PRINT"[RED] [RVSOFF]"SPC(9)"[RVSON]
[RVSOFF][5" "][c 2][RVSON][s +][RVSOFF][
7" "][RVSON][s +][RVSOFF][5" "][c 4][RVS
ON][s +][RVSOFF]"SPC(8)"[RVSON][s +]";     LI
•430 PRINT"[RED][11" "][RVSOFF][5" "][c 2
][RVSON][s +][RVSOFF]"SPC(13)"[c 4][RVSO
N][s +][RVSOFF]"SPC(8)"[RVSON][s +]";      LL
•440 PRINT"[RED] [RVSOFF]"SPC(9)"[RVSON]
[RVSOFF][5" "][c 2][RVSON][s +][RVSOFF]"
SPC(13)"[c 4][RVSON][s +][RVSOFF]"SPC(8)
"[RVSON][s +]";                            OG
•450 PRINT"[RED][11" "][RVSOFF][5" "][c 2
][RVSON][s +][RVSOFF][7" "][RVSON][s +][
RVSOFF][5" "][WHITE][SS][c 4]"SPC(8)"[RV
SON][s +]";                                HN
•460 PRINT"[RED] [WHITE][RVSOFF][s C][s C
][s I][c Z][s C][c X][c Z][s C][c X][RED
][RVSON] [RVSOFF][5" "][c 2][RVSON][s +]
[RVSOFF][7" "][RVSON][s +][RVSOFF]"SPC(1
4)"[c 4][RVSON][s +]";                     JG
•470 PRINT"[RED] [c 5][RVSOFF][s Q][GREEN
][s V][WHITE][s B]"SPC(12)"[c 2][RVSON][
s +][RVSOFF][7" "][RVSON][s +][RVSOFF][5
" "][c 4][RVSON][s +][RVSOFF]"SPC(8)"[RV
SON][s +]";                                OC
•480 PRINT"[RED] [WHITE][RVSOFF][s C][s C
][s K]"SPC(12)"[c 2][RVSON][s +][RVSOFF]
[7" "][RVSON][s +][RVSOFF][5" "][c 4][RV
SON][s +][RVSOFF]"SPC(8)"[RVSON][s +]";    DJ
•490 PRINT"[RED][4" "][RVSOFF][3" "][RVSO
N][4" "][RVSOFF][5" "][c 2][RVSON][9"[s
+]"][RVSOFF][5" "][c 4][RVSON][10"[s +]"
]";                                        FM
•500 PRINT"[BLACK] "SPC(38)"  "SPC(38)"
"SPC(38)" ";                               DF
•510 PRINT"[c 5][11"[s +]"][RVSOFF][5" "]
[c 8][RVSON][9"[s +]"][RVSOFF][5" "][c 5
][RVSON][10"[s +]"]";                      DD
•520 FORX=.TO2:PRINT"[s +][RVSOFF]"SPC(9)
"[RVSON][s +][RVSOFF][5" "][c 8][RVSON][
s +][RVSOFF][7" "][RVSON][s +][RVSOFF][5
" "][c 5][RVSON][s +][RVSOFF]"SPC(8)"[RV
SON][s +]";:NEXT                           NP
•530 PRINT"[4"[s +]"][RVSOFF][3" "][RVSON
][4"[s +]"][RVSOFF][5" "][c 8][RVSON][3"
[s +]"][RVSOFF][3" "][RVSON][3"[s +]"][R
VSOFF][5" "][c 5][RVSON][4"[s +]"][RVSOF
F][3" "][RVSON][3"[s +]"]";                OJ
•540 PRINT"[BLACK] "SPC(38)"  "SPC(38)" "
;                                          BC
•550 PRINT"[c 4][4"[s +]"][RVSOFF][3" "][
RVSON][4"[s +]"][RVSOFF][5" "][c 2][RVSO
N][9"[s +]"][RVSOFF][5" "][c 4][RVSON][4
"[s +]"][RVSOFF][3" "][RVSON][3"[s +]"]"
;                                          AM
•560 PRINT"[s +][RVSOFF]"SPC(9)"[RVSON][s
 +][RVSOFF][5" "][c 2][RVSON][s +][RVSOF
F][7" "][RVSON][s +][RVSOFF][5" "][c 4][
RVSON][s +][RVSOFF]"SPC(8)"[RVSON][s +]"
;                                          KB
•570 FORX=.TO1:PRINT"[s +][RVSOFF]"SPC(15
)"[c 2][RVSON][s +][RVSOFF]"SPC(13)"[c 4
][RVSON][s +][RVSOFF]"SPC(8)"[RVSON][s +
]";:NEXT                                   JF
•580 PRINT"[s +][RVSOFF]"SPC(9)"[RVSON][s
 +][RVSOFF][5" "][c 2][RVSON][s +][RVSOF
F][7" "][RVSON][s +][RVSOFF][5" "][c 4][
RVSON][s +][RVSOFF]"SPC(8)"[RVSON][s +]"
;                                          OF
•590 PRINT"[11"[s +]"][BLACK][5" "][c 2][
9"[s +]"][BLACK][5" "][c 4][10"[s +]"]";
:RETURN                                    CA
•600 REM PIZZA TEMPERATURE COLORS          PA
•610 DATA 1,7,10,3,11,8,1                  KN
•620 REM PIZZA DINER COORDS                ND
•630 DATA 175,74,290,71,54,154,175,154,29
4,154,55,213,175,213,290,213               HC
•640 REM MOB STARTING COORDS               EH
•650 DATA 60,93,,183,109,,129,,360,125,23
2,40,,,60,84                               HE
•660 REM SPRITE POINTERS                   HN
•670 DATA 56,58,59,59,60,59,62,63          MH
•680 REM DIRECTIONAL INDICATORS            NP
•690 DATA 270,180,,90,180                  CO
•700 REM FANFARE                           EH
•710 DATA"V101Q$BV202I$BV105.W$BV203I$B04
I$EV303IGI$BV204IGIGV3I$E03I$BV2IFI$EV30
3IGI$BV204IFQGV3Q$E03Q$BV204Q$EQ$EV303QG
"                                          NP
•720 REM MUSIC STRINGS                     AE
•730 DATA"V104T0U12X0SDDS#DV2T6U12X0V3T5U
12X0V104SEV204IRV303ICV105ICV204IEV303IG
V104SEV105ICV2IRV302I#AV204IEV303IGV104S
E05.QCV2IRV302IAV2IRV302I$AI$AV105SC"      EI
•740 DATA"V204IFV303I$AV105SDS#DV2IRV302I
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 87 and 88 explain these codes and provide other essential information on entering *Ahoy!* programs. Refer to these pages **before** entering any programs!

```
GV105SESCV204EV303IGV105SDIEV2IRV302IGV1
04SBIDV204IFV303IGV204HEV105HCV303IC02IG
QC"                                       IA
·750 REM SPRITE SHAPE DATA                MI
·760 DATA 0,,,,,,,,,,,,,,,,,F,80,,2,30,,
2                                         KK
·770 DATA 30,,1,FC,,,7A,,,7A,,,32,,,78,,
.84,,1,84,,,6                             HL
·780 DATA 0,,,,,,,,,,,,,,,,,,,,,,,,0      MB
·790 DATA 0,,,,,,,F,80,,2,30,,2,30,,1,FC,
,,7A,,,7A,0                               AB
·800 DATA 0,32,,,78,,,84,,,86,,1,80,,,,,,
,,,,,0                                    MB
·810 DATA 0,,,,,,,,,,,,,,,,,,,,,,,,0      FP
·820 DATA 40,,,80,,1,D8,C0,3,FF,E0,7,3F,D
0,,20,88,,20,88,,41,,,0                   GC
·830 DATA 0,,,,,,,,,,,,,,,,,,,,,,,,7,63   KG
·840 DATA 70,5,FF,D0,5,,50,7,,70,1,,40,1,
FF,C0,1,7F,40,1,80,C0,1,,40               PJ
·850 DATA 1,80,C0,1,7F,40,1,FF,C0,1,,40,7
,,70,5,,50,5,FF,D0,7,63,70,0              CA
·860 DATA 0,,,,,,,,,,,,,,,,,,7C,,3E,44,,2
2,7F                                      EA
·870 DATA FF,FE,21,42,84,61,81,86,21,81,8
4,21,81,84,61,81,86,21,42,84,7F,FF,FE,44
,0                                        AF
·880 DATA 22,7C,,3E,,,,,,,,,,,,,,,,,,,0   AB
·890 DATA 0,,,,,,,,,,1,,40,3,,60,,80,80,,
5D,,,2A,0                                 KE
·900 DATA 0,3E,,,14,,,14,,,3E,,,41,,3,80,
E0,1,,40,,,,,,,,,,,,,,0                   MC
·910 DATA 0,,,,,,,,,,,,50,,1,50,FF,81,51,
,41,22,80,A1,24                           DI
·920 DATA 41,15,65,A2,D3,75,88,D7,6C,8,19
,25,,51,24,80,91,22,7F,21,21,,41,,FF      OM
·930 DATA 80,,,,3,FF,E0,4,,10,3,FF,E0,,   KP
·940 REM REDEFINED CHARACTERS             FJ
·950 RESTORE980:BANK15:SUM=0:FORI=2816TO2
869:READJ:SUM=SUM+J:POKEI,J:NEXT:IFSUM<>
7491THENPRINT"ERROR!":END:ELSESYS2816:PO
KE2604,PEEK(2604)AND240OR8                PD
·960 RESTORE1060                          BE
·970 READA;IFA=-1THENRETURN:ELSEFORI=.TO7
:READB:POKE8192+A*8+I,B:NEXT:GOTO970      FB
·980 DATA 169,,133,250,133,252,169,208    JE
·990 DATA 133,251,169,32,133,253,169,252  NJ
·1000 DATA 141,185,2,169,16,141,54,11     OF
·1010 DATA 160,,169,250,162,14,32,116     MI
·1020 DATA 255,162,,32,119,255,200,208    DC
·1030 DATA 241,206,54,11,240,7,230,251    IO
·1040 DATA 230,253,76,26,11,96            CF
·1050 REM CHARACTER DATA                  FO
·1060 DATA81,,60,90,126,66,90,60,.        CF
·1070 DATA83,,60,106,86,106,86,60,.       GE
·1080 DATA86,,126,231,255,60,126,126,.    GK
·1090 DATA87,,60,90,126,66,66,60,.        JM
·1100 DATA88,248,88,124,26,25,36,36,102   LK
·1110 DATA160,182,109,219,182,109,219,182
,109                                      OA
·1120 DATA219,126,,,231,231,,,126,-1      JC
```

LEARNER
FROM PAGE 32

```
·1 REM==================================== NM
·2 REM        --- LEARNER ---             KE
·3 REM   AN EXPERIMENTAL MODEL FOR        BI
·4 REM        MACHINE LEARNING            NB
·5 REM                                    JC
·6 REM        RUPERT REPORT #48           ON
·7 REM             C-128                  KJ
·8 REM      (SEE TEXT FOR C-64)           AB
·9 REM==================================== CE
·10 DIM SENS(5),MEM(4,5),PROD(4),SCRN(21,
21)                                       MD
·20 FALSE=0 : TRUE=NOT FALSE              IL
·30 GOSUB 500           :REM INITIALIZE   OO
·40 GOSUB 800           :REM DRAW SCREEN  PB
·50 REM ================================== NK
·60 REM ====  MAIN PRGM  ================ BI
·70 REM ================================== PG
·80 LOSE=FALSE : WIN=FALSE                OA
·90 GOSUB 1000          :REM READ SENSORS PG
·100 GOSUB 1100         :REM GET MOVE     JD
·110 GOSUB 1900         :REM SHOW MEMORY  LE
·120 GOSUB 200          :REM CHECK KBD    GP
·130 GOSUB 1400         :REM MAKE MOVE    MJ
·140 GOSUB 1500         :REM INTERPRET MOVE FD
·150 GOSUB 1600         :REM UPDATE SCREEN AD
·160 GOSUB 1800         ;REM LEARN        BG
·170 GOTO 80                              JM
·200 REM ---------------------------------
------------------- CHECK KEYBOARD ----- LA
·210 GET A$ : IF A$<>"" THEN GOTO 250     IG
·220 IF SS THEN GET A$ : IF A$="" THEN GO
TO 220                                    KD
·230 IF A$<>"S" THEN SS=FALSE             FN
·240 GOTO 330   :REM  RETURN              LL
·250 IF A$<>"X" THEN GOTO 300             LP
·260 REM  -PRESS X TO EXIT-               NB
·270 CHAR 1,1,22                          AG
·280 END   :REM <<<<<<<<<<<<<<<<<<<<<<<<  CF
·290 REM  -S KEY TO SINGLE STEP-          BM
·300 IF A$="S" THEN SS=TRUE : GOTO 220    AN
·310 REM  -ANY OTHER KEY RANDOMIZES-      JM
·320 GOSUB 340   :REM MAKE RANDOM MOVE    IB
·330 RETURN                               NJ
·340 REM ------ PICK RANDOM SPOT -------- DO
·350 CHAR 1,XP,YP                         BE
·360 PRINT SC$(SCRN(XP,YP))               PD
·370 XP=INT(RND(0)*SZ+1)                  FA
```

```
•380 YP=INT(RND(0)*SZ+1)                    FH
•390 CHAR 1,XP,YP                           EM
•400 PRINT"X"                               MH
•410 RETURN                                 CJ
•500 REM -----------------------------------
----------------------- INITIALIZATION -- NF
•510 PRINT CHR$(147)    :REM CLEAR SCREEN DN
•520 FOR N=1 TO 18 : BL$=BL$+" " : NEXT   LH
•530 IF LEN(DS$)<>0 THEN BL$=CHR$(27)+"Q" AC
•540 SZ=10              :REM SIZE OF MATRIX EB
•550 FOR X=1 TO 4 : FOR Y=1 TO 5          IO
•560 MEM(X,Y)=1                             BE
•570 NEXT Y,X                               JO
•580 FOR N=0 TO 2 : READ SC$(N) : NEXT N  AF
•590 DATA ".","O","#"      :REM SCREEN CH
ARACTERS                                    HO
•600 BG=0 : TG=1 : BD=2 :REM BACKGROUND,
 TARGET, BORDER VALUES                      FP
•610 FOR X=1 TO SZ : FOR Y=1 TO SZ :REM
 NORMAL SCREEN VALUES                       BM
•620 SCRN(X,Y)=BG : NEXT Y,X                FI
•630 READ X,Y                               NJ
•640 IF X<>0 THEN SCRN(X,Y)=TG : GOTO 630 NG
•650 DATA 1,1,1,2,1,3,1,4,1,5,1,6,1,7,1,8
,2,8,3,8,4,8,5,8,6,8,7,8,8,8               HB
•655 DATA 8,7,8,6,8,5,8,4,8,3,8,2,8,1,0,0 PJ
•660 FOR X=0 TO SZ+1        :REM  BORDERS FF
•670 :SCRN(X,0)=BD : SCRN(X,SZ+1)=BD       NM
•680 NEXT X                                 IA
•690 FOR Y=0 TO SZ+1                        IE
•700 :SCRN(0,Y)=BD : SCRN(SZ+1,Y)=BD       LA
•710 NEXT Y                                 KF
•720 RETURN                                 GA
•800 REM -----------------------------------
--------------------DRAW SCREEN---------- CA
•810 FOR X=1 TO SZ      :REM DRAW MATRIX   NP
•820 :FOR Y=1 TO SZ                         HI
•830 : CHAR 1,X,Y                           JE
•840 : PRINT SC$(SCRN(X,Y))                 IO
•850 :NEXT Y                                GH
•860 NEXT X                                 DN
•870 GOSUB 370       :REM INITIAL CURSOR   GO
•880 CHAR 1,1,22                            GK
•890 PRINT"S=SINGLE STEP:X=EXIT:R=RANDOM" AO
•900 RETURN                                 BF
•1000 REM ----------------------------------
----------------------- READ SENSORS -- OO
•1010 SENS(1)=SCRN(XP,YP-1) :REM UP        FK
•1020 SENS(2)=SCRN(XP+1,YP) :REM RIGHT     OM
•1030 SENS(3)=SCRN(XP,YP+1) :REM DOWN      BK
•1040 SENS(4)=SCRN(XP-1,YP) :REM LEFT      OP
•1050 SENS(5)=SCRN(XP,YP)   :REM BODY      DG
•1060 RETURN                                LG
•1100 REM ----------------------------------
----------------------- GET MOVE -------- DJ
•1110 FOR COL=1 TO 4                        HF
•1120 :SUM=0                                HH
•1130 :FOR ROW=1 TO 5                       PD
•1140 : SUM=SUM + SENS(ROW)*MEM(COL,ROW)  AP
•1150 :NEXT ROW                             DA
•1160 :PROD(COL)=SUM                        PD
•1170 NEXT COL                              PH
•1180 REM                                   DB
•1190 MAX=PROD(1)                           OC
•1200 FOR COL=2 TO 4  :REM FIND MAX VALUE DC
•1210 IF PROD(COL)>MAX THEN MAX=PROD(COL) FC
•1220 NEXT COL                              CF
•1230 REM                                   GD
•1240 N=0 :REM FIND ALL SUMS EQUAL TO MAX FC
•1250 FOR COL=1 TO 4                        AB
•1260 :IF PROD(COL)=MAX THEN N=N+1 : TMP(
N)=COL                                      LK
•1270 NEXT COL                              GD
•1280 R=INT(RND(0)*N+1) :REM PICK RANDOM  MF
•1290 MOVE=TMP(R)    :REM MOVE FROM MAX'S GC
•1300 IF RND(0)*10 >10 THEN MOVE=INT(RND(
0)*4+1) :REM SOMETIMES PURELY RANDOM       EA
•1310 RETURN                                LB
•1400 REM ----------------------------------
------------------------ MAKE MOVE ----- IL
•1410 PREV=SCRN(XP,YP)   :REM SAVE OLD    FN
•1420 X0=XP                                 HD
•1430 Y0=YP                                 HN
•1440 ON MOVE GOSUB 1460,1470,1480,1490   CK
•1450 RETURN                                DN
•1460 YP=YP-1 : RETURN :REM UP              MD
•1470 XP=XP+1 : RETURN :REM RIGHT           HM
•1480 YP=YP+1 : RETURN :REM DOWN            GC
•1490 XP=XP-1 : RETURN :REM LEFT            GE
•1500 REM ----------------------------------
-----------------INTERPRET MOVE----------- KI
•1510 SCRN=SCRN(XP,YP)                      NM
•1520 IF SCRN=TG THEN WIN=TRUE              GE
•1530 IF SCRN<>TG THEN LOSE=TRUE            LK
•1540 RETURN                                JI
•1600 REM ----------------------------------
-------------------- UPDATE SCREEN ----- IA
•1610 CHAR 1,X0,Y0                          ND
•1620 PRINT SC$(SCRN(X0,Y0)) :REM RESTORE
 SCREEN                                     JC
•1630 CHAR 1,XP,YP                          BH
•1640 IF NOT LOSE THEN PRINT "X"            NL
•1650 CHAR 1,XP,YP                          EL
•1660 IF WIN THEN PRINT "*"                 JJ
•1670 IF LOSE THEN GOSUB 340                BL
•1680 CHAR 1,21,10                          MM
•1690 PRINT BL$                             OG
•1700 CHAR 1,21,10                          MA
•1710 IF LOSE THEN LS=LS+1 : PRINT "LOSER
" : SOUND 1,200,10                          BH
•1720 IF WIN THEN WN=WN+1 : PRINT "WINNER
" : SOUND 1,2000,10                         KP
•1730 CHAR 1,10,21                          PA
•1740 PRINT "WINS/LOSSES = " WN " / " LS   JM
•1750 RETURN                                GK
•1800 REM ----------------------------------
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 87 and 88 explain these codes and provide other essential information on entering *Ahoy!* programs. Refer to these pages **before** entering any programs!

```
---------------------- LEARN ---------- PL
·1810 REM  RETURN  :REM NO LEARNING      LF
·1820 IF NOT (LOSE OR WIN) THEN RETURN   KJ
·1830 IF LOSE THEN K=-1                  IN
·1840 IF WIN THEN K=1                    JK
·1850 FOR Y=1 TO 5                       NJ
·1860 MEM(MOVE,Y)=MEM(MOVE,Y)+K*SENS(Y)  GP
·1870 NEXT Y                             CK
·1880 RETURN                             ON
·1900 REM -------------------------------
-------------------- SHOW MEMORY ------ LK
·1910 FOR Y=1 TO 5                       BF
·1920 CHAR 1,21,Y                        KN
·1930 PRINT BL$                          OB
·1940 CHAR 1,21,Y                        MB
·1950 PRINT SENS(Y)                      BI
·1960 NEXT Y                             IM
·1970 FOR Y=1 TO 5                       EB
·1980 :CHAR 1,24,Y                       AO
·1990 :FOR X=1 TO 4                      JK
·2000 : PRINT MEM(X,Y);                  PP
·2010 :NEXT X                            PA
·2020 NEXT Y                             MA
·2030 CHAR 1,21,7                        PB
·2040 PRINT BL$  :REM BLANKS             ND
·2050 CHAR 1,24,7                        BH
·2060 FOR X=1 TO 4                       KK
·2070 PRINT PROD(X); : NEXT X            PH
·2080 CHAR 1,22,9                        DF
·2090 PRINT "NEXT MOVE =" MOVE           AN
·2100 RETURN                             MK
·2500 REM================================
VVVVVVVVVVVVVV   C-64 ONLY   VVVVVVVVVVVV KM
·2510 REM C-64 USERS MUST REPLACE THE    NH
·2520 REM CHAR STATEMENTS IN THESE LINES: IG
·2530 REM 270,350,390,830,880,1610,1630  OO
·2540 REM 1650,1680,1700,1730,1920,1940  BM
·2550 REM 1980,2030,2050,2080            DB
·2600 REM EACH STATEMENT OF THIS FORM:   PE
·2610 REM   CHAR 1,5,22  SHOULD BE       JM
·2620 REM REPLACED BY THE FOLLOWING:     KL
·2630 REM   XX=5 : YY=22 : GOSUB 2700    LL
·2640 REM YOU MUST USE XX AND YY.        HA
·2650 REM------------------------------- FF
·2660 REM YOU MUST ALSO DELETE THE SOUND CN
·2670 REM STATEMENTS IN LINES 1710 & 1720 IN
·2680 REM------------------------------- FD
·2700 IF XX<1 OR XX>24 THEN RETURN       EP
·2710 IF YY<0 OR YY>38 THEN RETURN       FP
·2720 POKE 214,XX-1 : PRINT              FK
·2730 POKE 211,YY : RETURN               JJ
```

Once you've typed in all this month's *Ahoy!* programs, you can start on our back issues. Most are available at $4.00 each (see page 85).

SILHOUETTE
FROM PAGE 18

BASIC PORTION

```
·100 IF PEEK(12351)<>65 THEN LOAD "SILSPR
ITES",8,1                                   EL
·110 DEF FNJY(X)=15-(PEEK(56320)AND15):DE
F FNJB(X)=(PEEK(56320)AND16)                DJ
·120 S=54272:FOR X=S TO S+24:READ A:POKE
X,A:NEXT                                    BF
·130 DATA 64,5,0,0,32,0,176,0,31,0,0,16,0
,250,0,5,0,0,128,0,248,0,0,0,15             NC
·140 FOR X=0 TO 4:READ FH(X),FL(X):NEXT:D
ATA 4,48,4,180,5,71,5,152,6,71              DM
·150 M$(1)="[4"C"][4"E"]G-D-C-":M$(2)="CD
E-EFG-GEFDC-":M$(3)="GGFFEEDDC-E-C-"        IK
·160 M$(4)="[3"G"]-[3"F"]-E-D-C-":M$(5)="
C-E-D-F-E-D-C-":M$(6)="GFEDGFEDG-E-C-"      LP
·170 V=53248:POKE V+29,126:POKE V+23,126:
POKE V+28,126:POKE V+37,0:POKE V+38,10      KO
·180 POKE V+39,1:POKE V+27,254:FOR X=1 TO
 6:READ CO(X):NEXT:DATA 6,11,2,6,0,2        OD
·190 FOR X=0 TO 10:READ XA(X),XX(X),XY(X)
:NEXT                                       KJ
·200 DATA 124,124,124,124,124,124,124,124
,124,0,0,0,52,124,124,52,68,90              LP
·210 DATA 52,68,170,0,0,0,196,124,124,196
,183,90,196,183,170                         FM
·220 FOR X=0 TO 3:READ BT(X),BB(X):NEXT:D
ATA 0,1,0,2,1,2,2,2                         JG
·230 A$="[RVSON][14" "]":B$="[RVSON][3" "
][8"[RIGHT]"][RVSON][3" "][RVSOFF]":C$="
[DOWN][14"[LEFT]"]"                         DG
·240 B$=B$+C$:A$=A$+C$:B1$(2)=A$+B$+B$+B$
+B$:B2$(2)=B$+B$+B$+A$+A$                   BO
·250 :D$="[RVSON][14"[c G]"][RVSOFF]":B1$
(1)="[8"[DOWN]"]"+D$+C$+D$+C$               GK
·260 B1$(0)="[10"[DOWN]"]":A$="[RVSON][10
" "]":B$=A$+A$+A$+A$:GN=5:TM=50:Q=RND(-T
I)                                          HC
·270 REM TITLE SCREEN                       PF
·280 POKE 53281,12:POKE 53280,12:PRINT "[
CLEAR][c 4]";:IF PEEK(2047)=65 THEN600      CF
·290 Y=60:SX=0:EX=255:IC=1:SP=95:SO=14:FL
=1:S1=3:S2=2:S3=1:GOSUB460                  DO
·300 PRINT TAB(12);"THE GOOD GUYS:"         EC
·310 PRINT"[6"[DOWN]"][3" "]POLICEMAN[3"
"]PROFESSOR[3" "]YOUNG LADY"                PF
·320 POKE 2044,194:POKE 2045,193:POKE 204
6,192:POKE V+8,PEEK(V+2)                    HG
·330 POKE V+9,Y:POKE V+10,PEEK(V+4):POKE
V+11,Y:POKE V+12,PEEK(V+6):POKE V+13,Y      ED
·340 POKE V+43,CO(S1):POKE V+44,CO(S2):PO
KE V+45,CO(S3):POKE V+21,112                FD
```

```
•350 Y=195:SX=0:EX=255:IC=1:SP=95:SO=126:
 FL=1:S1=6:S2=5:S3=4:GOSUB460                ML
•360 PRINT TAB(11);"[9"[DOWN]"]AND THE BA
 D GUYS:"                                     PF
•370 PRINT"[6"[DOWN]"][5" "]LOUIE[7" "]SL
 IM[9" "]REDD[HOME]":M$="-"+M$(3):GOSUB56
 0                                            OM
•380 POKE S+11,17:POKE S+11,16:PRINT TAB(
 5);"[8"[DOWN]"][s U][s *][s *][s I][3" "
 ][c S] [c S][3" "]IN[6" "][c S] [c S]"      CK
•390 PRINT TAB(5);"[s -][4" "]. [s -] [s
 -][10" "][s *][s +][s *][s +][s *]"         JG
•400 PRINT TAB(5);"[s J][s *][s *][s I] [
 c S] [s -] [c Q][s *][s I][s U][s *][s I
 ][c A] [c S][s U][s *][s I][s -] [s -] [
 s U][s *][s I]"                              FP
•410 PRINT TAB(5);"[3" "][s -] [s -] [s -
 ] [s -] [s -][s -][SS][s -][s -] [s -][c
  Q][s *][s K][s -] [s -] [c Q][s *][s K]
 "                                            JI
•420 PRINT TAB(5);"[s J][s *][s *][s K] [
 c E] [c E] [c E] [c E][s J][s *][s K][s
 J][s *][s K][s J][s *][s K][s J][s K][s
 J][s K][s J][s *][s K]"                      MO
•430 PRINT TAB(18);"BY":PRINT TAB(11);"CU
 RTIS F KAYLOR"                               BN
•440 WAIT 56464,16,16:POKE V+21,0:GN=5:GO
 TO600                                        GL
•450 REM MOVE SPRITES                         MC
•460 POKE 2041,198:POKE 2042,198:POKE 204
 3,198:Z1=0:Z2=256                            EA
•470 POKE V+2,0:POKE V+3,Y:POKE V+4,0:POK
 E V+5,Y:POKE V+6,0:POKE V+7,Y                CF
•480 POKE V+40,CO(S1):POKE V+41,CO(S2):PO
 KE V+42,CO(S3):POKE V+21,SO                  EA
•490 POKE S,64:POKE S+1,5:POKE S+4,33         PM
•500 FOR X=SX TO EX STEP 4*IC:POKE V+2,X:
 A=X-SP                                       NK
•510 POKE V+4,-A*(A>Z1 AND A<Z2):A=A-SP:P
 OKE V+6,-A*(A>Z1 AND A<Z2):NEXT              IE
•520 POKE S+4,32:IF FL=0 THEN RETURN          AK
•530 POKE S+11,17:POKE S+11,16                EF
•540 POKE 2041,191+S1:POKE 2042,191+S2:PO
 KE 2043,191+S3:RETURN                        DK
•550 REM PLAY MUSIC                           HI
•560 FOR X=1 TO LEN(M$):A=ASC(MID$(M$,X,1
 )):IF A=45 THEN GOTO580                      DL
•570 POKE S+4,32:POKE S,FL(A-67):POKE S+1
 ,FH(A-67):POKE S+4,33                        GI
•580 FOR PA=1 TO 100:NEXT PA,X:POKE S+4,3
 2:RETURN                                     LA
•590 REM RIFLE RANGE                          PF
•600 POKE 53280,11:PRINT "[CLEAR]";:FOR X
 =1 TO 10:PRINT B$;:NEXT                      FL
•610 PRINT TAB(8);"[UP][UP][RVSON]RIFLE
 RANGE[DOWN]":FOR X=1 TO 10:PRINT SPC(28)
 ;"[RVSON]  ";A$;:NEXT                        GN
•620 PRINT SPC(30);"[8"[UP]"]SCORE:[6"[LE
 FT]"][DOWN]";SC:PRINT SPC(30);"[DOWN][RV
 SON]GUNS:[DOWN][5"[LEFT]"]";GN               DG
•630 PRINT "[DOWN][DOWN]";B$;"  [s U][4"[
 s *]"][s I][3" "][s U][4"[s *]"][s I][3"
  "][s U][4"[s *]"][s I][4" "]";A$;"  [s
 -][4" "][s -][3" "][s -][4" "][s -][3" "
 ][s -]";                                     BM
•640 PRINT "[4" "][s -][4" "]";A$;"  [s J
 ][4"[s *]"][s K][3" "][s J][4"[s *]"][s
 K][3" "][s J][4"[s *]"][s K][4" "]";A$;"
 [LEFT]";B$;"[LEFT][INSERT] [HOME]"           NM
•650 POKE 2040,199:POKE V+1,185:POKE V,12
 4:POKE V+21,1                                PN
•660 FOR J=1 TO 7:S1=INT(RND(1)*3)+1:S2=I
 NT(RND(1)*3)+4                               PG
•670 IF RND(1)>.5 THEN SS=S1:S1=S2:S2=SS      GP
•680 S3=INT(RND(1)*6)+1:IF S3=S1 OR S3=S2
  THEN680                                     MC
•690 Y=168:SX=0:EX=185:IC=1:SP=72:SO=15:F
 L=1:GOSUB460                                 EA
•700 FOR K=1 TO TM                            KP
•710 JY=FNJY(0):POKE V,XA(JY):SR=PEEK(V+3
 0)AND14:IF FNJB(0) THEN760                   KA
•720 POKE S+18,129:POKE S+18,128:SR=LOG(S
 R)/LOG(2)                                    MG
•730 SN=PEEK(SR+2040)-191:POKE 2040+SR,19
 8                                            AD
•740 IF SN<4 THEN GOSUB1040:GOTO780           EN
•750 SC=SC+10:POKE 214,11:PRINT:POKE 211,
 70:PRINT "[RVSON]";SC:TM=TM+(TM>10)          JP
•760 NEXT K:FOR SR=1 TO 3:SN=PEEK(SR+2040
 )-191:IF SN>3 AND SN<7 THEN GOSUB1040        GJ
•770 NEXT SR                                  CH
•780 Y=168:SX=185:EX=0:IC=-1:SP=72:SO=15:
 FL=0:GOSUB460:POKE V+21,1                    BH
•790 NEXT J:M$=M$(6*RND(1)+1):GOSUB550:PR
 INT "[CLEAR]";                               HK
•800 REM CITY                                 OF
•810 FOR X=1 TO 20:PRINT SPC(28);"[RVSON]
  ";A$;:NEXT:PRINT B$;B$;B$;B$;"[UP][UP]
 ";SPC(5);                                    CN
•820 PRINT "SILHOUETTE  CITY":PRINT "[LEF
 T]";B$;"[LEFT][INSERT] [HOME][DOWN]";SPC
 (30);"SCORE:[6"[LEFT]"][DOWN]";SC            JF
•830 PRINT "[DOWN]";SPC(30);"[RVSON]GUNS:
 [5"[LEFT]"][DOWN]";GN:PRINT "[9"[DOWN]"]
 ";                                           DP
•840 PRINT SPC(31);"[RVSON][s U][4"[s *]"
 ][s I][DOWN][6"[LEFT]"][s -][4" "][s -][
 DOWN][6"[LEFT]"][s J][4"[s *]"][s K]"        AJ
•850 FOR J=1 TO 5:B1=INT(4*RND(1)):B2=INT
 (4*RND(1))                                   MG
•860 FOR X=0 TO 19:POKE 781.X:POKE 782,27
 :SYS 59905:NEXT X                            LJ
•870 PRINT "[HOME][c 2]";B1$(BT(B1));B2$(
 BT(B1));                                     BI
•880 PRINT  B1$(BB(B1));B2$(BB(B1));          GJ
•890 PRINT "[HOME]";SPC(14);B1$(BT(B2));B
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 87 and 88 explain these codes and provide other essential information on entering ***Ahoy!*** programs. Refer to these pages **before** entering any programs!

```
2$(BT(B2));                                        CA
•900 PRINT B1$(BB(B2));B2$(BB(B2));"[c 4]
[HOME]":POKE V,XX(0):POKE V+1,XY(0)                DL
•910 FOR K=1 TO 5:XX=INT(2*RND(1)):B0=-B1
*(XX=0)-B2*(XX=1)                                  KP
•920 YY=INT(RND(1)*(1-(BT(B0)<>0))):S1=(6
*RND(1))+1                                         OB
•930 Y=152-80*YY:SX=240*XX:EX=56+112*XX:I
C=1-2*XX:SO=3:FL=1:GOSUB460                        DA
•940 FOR L=1 TO TM/2:JY=FNJY(0):POKE V,XX
(JY):POKE V+1,XY(JY)                               FL
•950 SR=SGN(PEEK(V+30)AND2):IF FNJB(0) OR
 SR=0 THEN1000                                     CC
•960 POKE S+18,129:POKE S+18,128                   GB
•970 SN=PEEK(2041)-191:POKE 2041,198:IF S
R=0 THEN1000                                       LB
•980 IF SN<4 THEN GOSUB1030:GOTO1010               DL
•990 SC=SC+10:PRINT "[HOME][DOWN][DOWN][R
VSON]";SPC(30);SC:TM=TM+(TM>10)                    DC
•1000 NEXT L:SN=PEEK(2041)-191:IF SN>3 AN
D SN<7 THEN GOSUB1030                              LK
•1010 AA=EX:EX=SX:SX=AA:IC=-IC:FL=0:GOSUB
460                                                MJ
•1020 NEXT K:M$=M$(6*RND(1)+1):GOSUB550:N
EXT J:GOTO600                                      CE
•1030 GX=5:POKE 2041,SN+191:POKE 214,17:P
RINT:POKE 211,32:GOTO1050                          AI
•1040 GX=15:POKE 2040+SR,SN+191:POKE 214,
21:PRINT:POKE 211,3+9*(3-SR)                       JD
•1050 PRINT "[RVSON]MISS[4"[LEFT]"]";:M$=
"[5"E"]":GOSUB560:PRINT "[RVSON][4" "]":
GN=GN-1:TM=TM+1                                    AC
•1060 POKE 214,GX:PRINT:POKE 211,30:PRINT
 "[RVSON]";GN;"[LEFT] ":IF GN>0 THEN RET
URN                                                PN
•1070 PRINT"[HOME][RVSON][5" "]PLAY AGAIN
?  (Y/N)[5" "]":GET A$:IF A$="" AND FNJB
(0) THEN1070                                       NL
•1080 IF A$="N" THEN POKE 2047,0:POKE V+2
1,0:PRINT"[CLEAR]";:END                            OH
•1090 POKE 2047,65:RUN                             PB
```

SILSPRITES

Starting address in hex: 3000
Ending address in hex: 31FF

```
3000: 00 AA 00 00 AA 00 00 FF 55
3008: 00 03 7D C0 03 FF C0 00 0D
3010: D7 00 00 FF 00 00 AA 00 92
3018: 0A AA A0 0A AA A0 0A A9 76
3020: A0 0A A6 60 0A A9 A0 0A 30
3028: AA A0 0A AA A0 0A AA A0 1E
3030: 0A AA A0 0A AA A0 0A AA 8F
3038: A0 0A AA A0 0A AA A0 41 C4
3040: 00 AA 00 02 AA 80 00 FF 18
3048: 00 03 7D C0 03 FF C0 00 4D
3050: D7 00 00 FF 00 00 AA 00 D2
3058: 0A AA A0 0A 96 A0 0A AA A3
3060: A0 0A AA A0 0A 96 A0 0A A1
3068: AA A0 0A AA A0 0A 96 A0 4A
3070: 0A AA A0 0A AA A0 0A 96 BB
3078: A0 0A AA A0 0A AA A0 BF 83
3080: 00 55 00 00 55 00 01 FF 2C
3088: 40 01 7D 40 01 FF 40 01 C9
3090: D7 40 01 FF 40 01 AA 40 D5
3098: 02 AA 80 02 AA 80 02 AA 9F
30A0: 80 02 69 80 02 69 80 02 FA
30A8: 69 80 02 69 80 02 69 80 6A
30B0: 02 69 80 02 69 80 02 69 F3
30B8: 80 02 69 80 02 69 80 99 AA
30C0: 00 AA 00 02 AA 80 00 FF 98
30C8: 00 03 7D C0 03 FF C0 00 CD
30D0: D7 00 00 FF 00 00 AA 00 53
30D8: 0A AA A0 0A AA A0 0A AA 38
30E0: A0 0A AA A0 0A AA A0 0A 36
30E8: AA A0 0A AA A0 0A AA A0 DE
30F0: 09 AA A0 09 AA A0 0F AA 53
30F8: A0 0F AA A0 0F AA A0 00 4E
3100: 00 55 00 00 55 00 00 FF AA
3108: 00 03 7D C0 03 FF C0 00 0D
3110: D7 00 00 FF 00 00 55 00 3D
3118: 01 55 40 01 55 40 01 55 9B
3120: 40 01 55 40 01 55 40 01 8E
3128: 55 40 01 55 40 01 55 40 EA
3130: 01 55 40 01 55 40 01 55 B3
3138: 40 01 55 40 01 55 40 2E D3
3140: 00 AA 00 00 AA 00 00 FF 95
3148: 00 03 7D C0 03 FF C0 00 4D
3150: D7 00 00 FF 00 00 55 00 7D
3158: 05 55 50 05 69 50 05 55 1C
3160: 50 05 55 50 05 69 50 05 1F
3168: 55 50 05 55 50 05 69 50 77
3170: 05 55 50 05 55 50 05 69 34
3178: 50 05 55 50 05 55 50 42 60
3180: 00 10 00 00 10 00 00 10 B0
3188: 00 00 10 00 00 10 00 00 A8
3190: 10 00 00 10 00 00 10 00 C0
3198: 00 10 00 00 10 00 00 10 C8
31A0: 00 00 10 00 00 10 00 00 C0
31A8: 10 00 00 10 00 00 10 00 D8
31B0: 00 10 00 00 10 00 00 10 E0
31B8: 00 00 10 00 00 10 00 00 D8
31C0: 00 18 00 00 18 00 00 18 09
31C8: 00 00 18 00 00 18 00 00 F8
31D0: 18 00 00 18 00 00 18 00 19
31D8: 00 18 00 00 18 00 FF FF 09
31E0: FF 00 18 00 00 18 00 00 11
31E8: 18 00 00 18 00 00 18 00 31
31F0: 00 18 00 00 18 00 00 18 39
31F8: 00 00 18 00 00 18 00 FF 29
```

TAKE TWO
FROM PAGE 49

```
•10 REM *** TAKE TWO *** BUCK CHILDRESS *
**                                        KI
•20 REM *** P.O. BOX 13575 SALEM, OR 9730
9 ***                                     OA
•30 PRINTCHR$(147)"LOADING AND CHECKING D
ATA LINE:":J=49152                        EO
•40 FORB=0TO11:READA                      MB
•50 IFB=0THENL=PEEK(64)*256+PEEK(63):PRIN
TCHR$(19)TAB(31)L:PRINT                   PF
•60 IFA<0ORA>255THEN80                    FK
•70 POKEJ+B,A:X=X+A:D=D+1:NEXTB:READA:IFA
=XTHEN90                                  PL
•80 PRINT"ERROR IN DATA LINE:"L:END       MG
•90 X=0:J=J+12:IFD<252THEN40              KE
•100 PRINT"THE DATA IS OK[3"."]":PRINT    FB
•110 PRINT"SYS 49152 TO ACTIVATE[3"."]":E
ND                                        OB
•120 DATA169,160,162,224,160,0,133,252,13
4,254,132,251,2031                        CM
•130 DATA132,253,177,251,145,251,177,253,
145,253,230,251,2518                      GI
•140 DATA230,253,208,242,230,252,230,254,
208,236,169,76,2588                       IA
•150 DATA162,100,160,192,141,68,229,142,6
9,229,140,70,1702                         FC
•160 DATA229,169,76,162,109,160,192,141,2
34,232,142,235,2081                       IE
•170 DATA232,140,236,232,169,76,162,118,1
60,192,141,129,1987                       EO
•180 DATA233,142,130,233,140,131,233,169,
127,162,192,120,2012                      PL
•190 DATA141,143,2,142,144,2,169,47,162,5
3,133,0,1138                              GP
•200 DATA134,1,88,96,32,191,192,173,136,2
,76,71,1192                               MB
•210 DATA229,32,191,192,165,172,72,76,237
,232,32,191,1821                          KJ
•220 DATA192,165,172,72,76,132,233,173,14
1,2,201,2,1561                            NF
•230 DATA208,54,165,203,174,246,192,141,2
46,192,228,203,2252                       MM
•240 DATA240,42,201,3,208,38,169,194,162,
4,160,0,1421                              NC
•250 DATA32,218,192,169,198,162,216,32,21
8,192,162,25,1816                         JH
•260 DATA189,247,192,149,217,202,16,248,2
32,134,199,134,2159                       EO
•270 DATA207,134,212,134,216,32,102,229,7
6,72,235,169,1818                         MK
•280 DATA4,162,194,160,0,32,218,192,169,2
16,162,198,1707                           BI
•290 DATA32,218,192,162,25,181,217,157,24
7,192,202,16,1841                         HL
•300 DATA248,96,133,252,134,254,132,251,1
32,253,162,3,2050                         ML
•310 DATA177,251,145,253,230,251,230,253,
208,246,230,252,2726                      GE
•320 DATA230,254,202,16,239,96,65,46,72,4
6,83,46,1395                              KJ
```

REDIRECT
FROM PAGE 70

REDIRECT C-64

```
•0 REM *** REDIRECT C-64 ***              HA
•10 FORJ=49152TO49240:READA:POKEJ,A:NEXTJ AB
•20 PRINTCHR$(147)TAB(16)CHR$(18)"REDIREC
T"                                        JP
•30 L$=" [38"-"]"                         OD
•40 J=0:S=1:N$="":PRINT:PRINT"FILE NAME?
";:PRINTCHR$(34);                         EJ
•50 POKE204,0:GETA$:IFA$=""THEN50         BE
•60 IFA$=CHR$(13)THENPOKE204,1:PRINTCHR$(
34)A$:GOTO120                             HK
•70 IFJ>15THENPOKE204,1:PRINTA$:GOTO110   OK
•80 IFA$=CHR$(20)ANDJ<1THEN50             FA
•90 PRINTA$;:IFA$=CHR$(20)THENJ=J-1:N$=LE
FT$(N$,J):GOTO50                          DK
•100 N$=N$+A$:J=J+1:GOTO50                HE
•110 PRINT:PRINTCHR$(18)"YOU ARE OVER THE
 16 CHARACTER LIMIT.":GOTO40              HP
•120 IFN$=""THENPRINTCHR$(18)"PLEASE ENTE
R A FILE NAME.":GOTO40                    FK
•130 IFN$="$"THENSYS49152:POKE198,0:GOSUB
470:CLOSE15:PRINTL$:GOTO40                PM
•140 R$=CHR$(34)+N$+CHR$(34)              BC
•150 PRINT"SEARCHING FOR ";R$             AK
•160 IFLEN(N$)<16THENN$=N$+CHR$(160):GOTO
160                                       AA
•170 OPEN15,8,15:OPEN5,8,5,"#"            PG
•180 PRINT#15,"U1";5;0;18;S:GOSUB480:L=4  LG
•190 B$="":J=1                            HH
•200 PRINT#15,"B-P";5;J+L:GET#5,A$:IFA$="
"THENA$=CHR$(0)                           AE
•210 B$=B$+A$:IFLEFT$(B$,J)<>LEFT$(N$,J)T
HEN240                                    IP
•220 J=J+1:IFJ>16THEN290                  GH
•230 GOTO200                              AA
•240 L=L+32:IFL<229THEN190                LP
•250 FORP=0TO1:PRINT#15,"B-P";5;P:GET#5,A
$:IFA$=""THENA$=CHR$(0)                   GO
•260 A(P)=ASC(A$):NEXTP:IFA(0)<>18ORA(1)<
1ORA(1)>18THEN280                         PM
•270 S=A(1):GOTO180                       CC
•280 PRINT:PRINT"UNABLE TO LOCATE ";R$:GO
TO390                                     JB
•290 GOSUB440:PRINT:PRINTL$:IFCT=1THEN310 NN
•300 F1$=F2$:S1=S:L1=L:CT=1:CLOSE5:CLOSE1
5:GOTO40                                  CI
•310 PRINT"SWAPPING[3"."]":PRINTL$        FA
•320 PRINT#15,"U1";5;0;18;S:GOSUB480      IP
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 87 and 88 explain these codes and provide other essential information on entering ***Ahoy!*** programs. Refer to these pages **before** entering any programs!

```
·330 PRINT#15,"B-P";5;L:PRINT#5,F1$;            GK
·340 PRINT#15,"U2";5;0;18;S:GOSUB480            KI
·350 PRINT#15,"U1";5;0;18;S1:GOSUB480           NB
·360 PRINT#15,"B-P";5;L1:PRINT#5,F2$;           BO
·370 PRINT#15,"U2";5;0;18;S1:GOSUB480           NI
·380 PRINT"DONE[3"."]"                          BK
·390 CLOSE5:CLOSE15:PRINTL$:PRINT               IP
·400 INPUT"ANOTHER SWAP (Y/N/$)";A$:IFA$=
"Y"THENCLR:GOTO20                               DC
·410 IFA$="N"THENEND                            OG
·420 IFA$="$"THENSYS49152:POKE198,0:GOSUB
470:CLOSE15:PRINTL$:PRINT                       ED
·430 GOTO400                                    MN
·440 F2$="":L=L-2:FORJ=0TO29                    KP
·450 PRINT#15,"B-P";5;J+L:GET#5,A$:IFA$="
"THENA$=CHR$(0)                                 IP
·460 F2$=F2$+A$:NEXTJ:RETURN                    GP
·470 OPEN15,8,15                                NN
·480 INPUT#15,EN,EM$,ET,ES:IFEN=0THENRETU
RN                                              FH
·490 PRINTEN;EM$;ET;ES:CLOSE5:CLOSE15:END MI
·500 DATA32,68,229,169,36,133,251,169,5,1
62,8,160                                        FJ
·510 DATA0,32,186,255,169,1,162,251,160,0
,32,189                                         IP
·520 DATA255,32,192,255,162,5,32,198,255,
32,207,255                                      AI
·530 DATA32,207,255,32,207,255,32,207,255
,32,207,255                                     HO
·540 DATA72,32,207,255,168,104,170,165,14
4,208,22,152                                    AP
·550 DATA32,205,189,169,32,32,210,255,32,
207,255,208                                     IF
·560 DATA248,169,13,32,210,255,184,80,214
,32,204,255                                     HD
·570 DATA169,5,76,195,255                       PG
```

REDIRECT C-128

```
·0 REM *** REDIRECT C-128 ***                   LF
·10 PRINTCHR$(147)TAB(16)CHR$(18)"REDIREC
T"                                              KN
·20 L$=" [38"-"]"                               NF
·30 J=0:S=1:N$="":PRINT:PRINT"FILE NAME?
";:PRINTCHR$(34);                               LP
·40 POKE2599,0:GETA$:IFA$=""THEN40              DP
·50 IFA$=CHR$(13)THENPOKE2599,1:PRINTCHR$
(34)A$:GOTO110                                  OJ
·60 IFJ>15THENPOKE2599,1:PRINTA$:GOTO100        IE
·70 IFA$=CHR$(20)ANDJ<1THEN40                   GD
·80 PRINTA$;:IFA$=CHR$(20)THENJ=J-1:N$=LE
FT$(N$,J):GOTO40                                ED
·90 N$=N$+A$:J=J+1:GOTO40                       JL
·100 PRINT:PRINTCHR$(18)"YOU ARE OVER THE
 16 CHARACTER LIMIT.":GOTO30                    LC
·110 IFN$=""THENPRINTCHR$(18)"PLEASE ENTE
R A FILE NAME.":GOTO30                          BF
·120 IFN$="$"THENDIRECTORY:POKE208,0:GOSU
B460:CLOSE15:PRINTL$:GOTO30                     DH
·130 R$=CHR$(34)+N$+CHR$(34)                    IA
·140 PRINT"SEARCHING FOR ";R$                   PE
·150 IFLEN(N$)<16THENN$=N$+CHR$(160):GOTO
150                                             BJ
·160 OPEN15,8,15:OPEN5,8,5,"#"                  AE
·170 PRINT#15,"U1";5;0;18;S:GOSUB470:L=4        FN
·180 B$="":J=1                                  IF
·190 PRINT#15,"B-P";5;J+L:GET#5,A$:IFA$="
"THENA$=CHR$(0)                                 EK
·200 B$=B$+A$:IFLEFT$(B$,J)<>LEFT$(N$,J)T
HEN230                                          AC
·210 J=J+1:IFJ>16THEN280                        EE
·220 GOTO190                                    PI
·230 L=L+32:IFL<229THEN180                      LM
·240 FORP=0TO1:PRINT#15,"B-P";5;P:GET#5,A
$:IFA$=""THENA$=CHR$(0)                         KM
·250 A(P)=ASC(A$):NEXTP:IFA(0)<>18ORA(1)<
1ORA(1)>18THEN270                               FK
·260 S=A(1):GOTO170                             AD
·270 PRINT:PRINT"UNABLE TO LOCATE ";R$:GO
TO380                                           IM
·280 GOSUB430:PRINT:PRINTL$:IFCT=1THEN300 CJ
·290 F1$=F2$:S1=S:L1=L:CT=1:CLOSE5:CLOSE1
5:GOTO30                                        OF
·300 PRINT"SWAPPING[3"."]":PRINTL$              AO
·310 PRINT#15,"U1";5;0;18;S:GOSUB470            KC
·320 PRINT#15,"B-P";5;L:PRINT#5,F1$;            LA
·330 PRINT#15,"U2";5;0;18;S:GOSUB470            KH
·340 PRINT#15,"U1";5;0;18;S1:GOSUB470           OO
·350 PRINT#15,"B-P";5;L1:PRINT#5,F2$;           IE
·360 PRINT#15,"U2";5;0;18;S1:GOSUB470           JB
·370 PRINT"DONE[3"."]"                          PI
·380 CLOSE5:CLOSE15:PRINTL$:PRINT               MB
·390 INPUT"ANOTHER SWAP (Y/N/$)";A$:IFA$=
"Y"THENCLR:GOTO10                               HN
·400 IFA$="N"THENEND                            PM
·410 IFA$="$"THENDIRECTORY:POKE208,0:GOSU
B460:CLOSE15:PRINTL$:PRINT                      MJ
·420 GOTO390                                    MN
·430 F2$="":L=L-2:FORJ=0TO29                    FJ
·440 PRINT#15,"B-P";5;J+L:GET#5,A$:IFA$="
"THENA$=CHR$(0)                                 ON
·450 F2$=F2$+A$:NEXTJ:RETURN                    JN
·460 OPEN15,8,15                                LP
·470 INPUT#15,EN,EM$,ET,ES:IFEN=0THENRETU
RN                                              KJ
·480 PRINTEN;EM$;ET;ES:CLOSE5:CLOSE15:END NG
```

Problems entering a program?

Call *Ahoy!* from 8:30-5:00 EST at 212-239-6089 (if busy or no answer after three rings, call 212-239-0855).

CLIFFHANGER
FROM PAGE 31

BASIC PORTION

```
•2 REM    CLIFFHANGER-JC HILTY-7/87                  AE
•5 GOTO12                                            PE
•10 POKES+4,0                                        DK
•11 POKES+24,15:POKES+1,10:POKES,100:POKE
S+5,3:POKES+6,1:POKES+4,129:RETURN                   IO
•12 GOSUB900                                         DF
•13 GOSUB800                                         DH
•14 POKE49600,252                                    FJ
•20 JY=PEEK(56320)AND15                              JJ
•21 IFJY=7THEN30                                     DL
•22 IFJY=11THEN40                                    HJ
•23 IFJY=13THEN50                                    HJ
•24 IFJY=14THEN60                                    IK
•25 IFPEEK(R)=32THEN200                              GI
•26 W1=PEEK(V+30):IFW1AND1THENPOKE49600,0
:GOTO350                                             BD
•27 ONLGOTO70,75,80,85,90,100                        ED
•28 L=L+1:IFL=7THENL=1                               BD
•29 GOTO20                                           AL
•30 X1=X1+8:IFX1>252THENX1=252:GOTO25                CP
•32 R=R+1:POKEV,X1:GOSUB10:GOTO25                    IG
•40 X1=X1-8:IFX1<28THENX1=28:GOTO25                  MP
•42 R=R-1:POKEV,X1:GOSUB10:GOTO25                    IP
•50 Y1=Y1+8:IFY1>204THENY1=204:GOTO25                KL
•52 R=R+40:POKEV+1,Y1:GOSUB10:GOTO25                 MG
•60 Y1=Y1-8:R=R-40:POKEV+1,Y1:GOSUB10:GOT
O25                                                  MK
•70 BO=BO-10:PRINT"[HOME][DOWN]"TAB(33)"[
3" "]":PRINT"[HOME][DOWN][c 7]"TAB(32)BO
:IFBO=0THEN200                                       NP
•72 GOTO28                                           DI
•75 FORX=2044TO2047:POKEX,Z:NEXT:Z=Z+1:IF
Z=196THENZ=192                                       CP
•76 GOTO28                                           DM
•80 IFPEEK(V+4)>190THENPOKEV+4,68                    DM
•82 GOTO28                                           EK
•85 IFPEEK(V+12)<LBTHENPOKE49613,2:POKE49
500,64                                               GP
•86 IFPEEK(V+12)>RBTHENPOKE49613,254:POKE
49500,64                                             OC
•87 IFPEEK(V+13)>200THENPOKE49614,254:POK
E49500,64                                            LC
•88 IFPEEK(V+13)<100THENPOKE49614,2:POKE4
9500,64                                              BM
•89 GOTO28                                           EP
•90 IFPEEK(V+6)<60THENPOKEV+6,210                    BH
•91 GOTO28                                           EJ
•100 IFPEEK(V+14)<PEEK(V)THENPOKE49615,PL
:POKE49500,128                                       PG
•102 IFPEEK(V+14)>PEEK(V)THENPOKE49615,PH
:POKE49500,128                                       KK
•104 IFPEEK(V+15)<PEEK(V+1)THENPOKE49616,
PL:POKE49500,128                                     LI
•106 IFPEEK(V+15)>PEEK(V+1)THENPOKE49616,
PH:POKE49500,128                                     NM
•108 POKEV+16,0:GOTO28                               BG
•200 POKE49600,0                                     ML
•202 Y1=Y1+4:IFY1>220THEN250                         CN
•204 POKEV+1,Y1:GOSUB10:GOTO202                      OA
•250 POKE2040,197:LI=LI-1:PRINT"[HOME][4"
[DOWN]"][BLUE]"TAB(32)LI                             JP
•252 FORX=0TO24:POKES+X,0:NEXT:SP=10:POKE
S,150:POKES+1,SP:POKES+6,240                         PH
•254 POKES+24,15:POKES+4,17                          AF
•256 FORSP=10TO250STEP4:POKES+1,SP:NEXT              JK
•258 FORX=0TO24:POKES+X,0:NEXT                       FH
•260 IFLI=0THEN400                                   EK
•262 POKEV+21,0:POKE2040,196:R=1879:X1=13
2:Y1=204:BO=500:PRINT"[HOME][DOWN][BLUE]
"TAB(32)BO                                           HE
•263 GOSUB850                                        DD
•264 IFLE=1THEN14                                    CB
•265 PH=INT(3*RND(4)+252):PL=INT(3*RND(5)
+2)                                                  AP
•266 GOTO14                                          PE
•350 IFW1AND2THEN360                                 IF
•352 GOTO200                                         HJ
•360 SC=SC+BO:PRINT"[HOME][7"[DOWN]"][BLU
E]"TAB(32)SC                                         MK
•362 POKES+1,130:POKES+5,9:POKES+15,30:PO
KES+24,15:QQ=1                                       KC
•363 FORX=1TO12:POKES+4,21:POKEV+40,QQ:QQ
=QQ+1:FORT=0TO100:NEXT                               DH
•364 POKES+4,20:FORT=0TO100:NEXT:NEXT                KC
•366 FORX=0TO24:POKES+X,0:NEXT:POKEV+40,4            EM
•368 LE=LE+1:PRINT"[HOME][13"[DOWN]"][BLU
E]"TAB(32)LE                                         FN
•369 PH=INT(3*RND(4)+252):PL=INT(3*RND(5)
+2)                                                  FH
•371 POKEV+21,0:POKE2040,196:R=1879:X1=13
2:Y1=204:BO=500:PRINT"[HOME][DOWN][BLUE]
"TAB(32)BO                                           CF
•372 GOSUB850:GOTO14                                 LI
•400 POKEV+21,0:PRINT"[CLEAR]":FORX=2041T
O2043:POKEX,Z:NEXT:POKE53280,0                       EE
•402 POKEV+40,2:POKEV+41,14:POKEV+42,7:PO
KEV+23,14:POKEV+29,14:POKEV+28,14                    FA
•404 POKEV+2,50:POKEV+3,180:POKEV+4,150:P
OKEV+5,180:POKEV+6,250:POKEV+7,180                   NE
•405 PRINT"[4"[DOWN]"][c 7]"TAB(11)"G A M
 E  O V E R":PRINT:PRINT                             NL
•406 IFSC>HSTHENHS=SC                                JF
•408 PRINTTAB(11)"SCORE  "SC:PRINT:PRINTT
AB(11)"HIGH[3" "]"HS:PRINT                           BM
•409 POKEV+21,14:RESTORE                             ML
•410 PRINTTAB(6)"[c 1]PRESS ANY KEY TO PL
AY AGAIN"                                            CC
•411 GOSUB938                                        MK
•412 PL=3:PH=252:LI=4:LE=1:SC=0:BO=500:X1
```

```
=132:Y1=204:R=1879:L=1                          KL
·414 GOTO13                                     IJ
·800 POKE53280,2:PRINT"[CLEAR][RED][RVSON
]CLIFFHANGER"TAB(33)"[RVSOFF][BLUE]BONUS
":PRINTTAB(32)BO:PRINT                          IB
·802 PRINTTAB(9)"[c 2][RVSON][sEP] [RVSOF
F][3" "][RVSON][sEP] [c *][RVSOFF][3" "]
[RVSON] [c *]"TAB(33)"[RVSOFF][BLUE]LIVE
S"                                              HM
·804 PRINTTAB(9)"[RVSON][c 1]  [RVSOFF][3
" "][RVSON][3" "][RVSOFF][3" "][RVSON]
[RVSOFF][BLUE]"TAB(32)LI                        NB
·806 PRINTTAB(8)"[RVSON][c 2][sEP]  [RVSO
FF] [RVSON][sEP][3" "][c *][RVSOFF]  [R
VSON]  [c *]"                                   EC
·808 PRINTTAB(8)"[RVSON][c 1][3" "][RVSOF
F]  [RVSON][5" "][RVSOFF]  [RVSON][3" "]
[RVSOFF][BLUE]"TAB(33)"SCORE"                   NP
·810 PRINTTAB(7)"[RVSON][c 2][sEP][15" "]
[c *][RVSOFF][BLUE]"TAB(32)SC                   JG
·812 PRINTTAB(7)"[RVSON][c 1][17" "]"           LO
·814 PRINTTAB(6)"[RVSON][c 2][sEP][4" "][
RVSOFF][9" "][RVSON][4" "][c *][RVSOFF][
BLUE]"TAB(33)"HIGH"                             IO
·816 PRINTTAB(6)"[RVSON][c 1][5" "][RVSOF
F][9" "][RVSON][5" "][RVSOFF][BLUE]"TAB(
32)HS                                           DE
·818 PRINTTAB(5)"[RVSON][c 2][sEP][5" "][
RVSOFF][9" "][RVSON][5" "][c *]"                IB
·820 PRINTTAB(5)"[RVSON][c 1][6" "][RVSOF
F][9" "][RVSON][6" "][RVSOFF][BLUE]"TAB(
33)"LEVEL"                                      NG
·822 PRINTTAB(4)"[RVSON][c 2][sEP][15" "]
[RVSON][6" "][c *][RVSOFF][BLUE]"TAB(32)
LE                                              GF
·824 PRINTTAB(4)"[RVSON][c 1][16" "][RVSO
N][7" "]"                                       OC
·826 PRINTTAB(3)"[RVSON][c 2][sEP][7" "][
RVSOFF][9" "][RVSON][7" "][c *]"                CH
·828 PRINTTAB(3)"[RVSON][c 1][8" "][RVSOF
F][9" "][RVSON][8" "]"                          PL
·830 PRINTTAB(2)"[RVSON][c 2][sEP][8" "][
RVSOFF][9" "][RVSON][8" "][c *]"                ND
·832 PRINTTAB(2)"[RVSON][c 1][9" "][RVSOF
F][9" "][RVSON][9" "]"                          PB
·834 PRINT" [RVSON][c 2][sEP][27" "][c *]
"                                               FM
·836 PRINT" [RVSON][c 1][29" "]"                PC
·838 PRINT"[RVSON][c 2][sEP][29" "][c *]"       KC
·840 PRINT"[RVSON][c 1][31" "]"                 PK
·850 FORX=49601TO49616:POKEX,0:NEXT:POKE4
9500,255:POKE49600,0:SYS49376                   DI
·852 POKEV+23,0:POKEV+29,0:POKEV+28,253         GI
·854 POKE2040,196:POKEV+39,5:POKEV,X1:POK
EV+1,Y1                                         FD
·856 POKE2041,199:POKEV+40,4:POKEV+2,136:
POKEV+3,58                                      EF
·858 POKE2042,198:POKEV+41,5:POKEV+4,142:
POKEV+5,094                                     IL
·860 POKE2043,198:POKEV+42,5:POKEV+6,142:
POKEV+7,142                                     IL
·862 POKE2044,Z:POKEV+43,14:POKEV+8,80:PO
KEV+9,190                                       PG
·864 POKE2045,Z:POKEV+44,2:POKEV+10,186:P
OKEV+11,70                                      AB
·866 POKE2046,Z:POKEV+45,7:POKEV+12,116:P
OKEV+13,120                                     AO
·868 POKE2047,Z:POKEV+46,13:POKEV+14,166:
POKEV+15,120                                    NC
·870 POKE49605,2:POKE49607,253:POKE49610,
255:POKE49612,2                                 BG
·872 POKE49614,2:POKE49613,253:POKE49500,
252                                             PE
·880 POKEV+21,255:FORX=0TO24:POKES+X,0:NE
XT:W1=PEEK(V+30):RETURN                         LP
·900 POKE53281,0:POKE53280,0:PRINT"[CLEAR
][4"[DOWN]"][GREEN]ONE MOMENT[4"."]LOADI
NG DATA[4"."]"                                  CE
·902 POKE147,0:SYS57812"CLIFFHANGER.ML",8
,1:SYS62631                                     KP
·904 POKE147,0:SYS57812"CLIFFHANGER.SP",8
,1:SYS62631                                     ID
·906 V=53248:S=54272:LI=4:LE=1:SC=0:BO=50
0:X1=132:Y1=204:R=1879:L=1:LB=40:RB=200         KB
·907 PL=3:PH=252                                DL
·908 POKEV+16,0:POKE2040,200:Z=192:POKE20
41,Z:POKE2042,Z:POKE2043,Z                      OC
·910 POKEV+23,15:POKEV+29,15:POKEV+28,14:
POKEV+37,1:POKEV+38,0:POKEV+39,8                JA
·912 POKEV+40,2:POKEV+41,14:POKEV+42,5:PO
KEV,120:POKEV+1,60:POKEV+2,160                  NO
·914 POKEV+3,200:POKEV+4,60:POKEV+5,200:P
OKEV+6,250:POKEV+7,200:POKEV+21,15              HD
·916 PRINT"[CLEAR][DOWN][DOWN][c 1]"TAB(2
0)"PRESENTS[DOWN][DOWN]"                        BH
·918 PRINTTAB(7)"[BLUE][RVSON] [RVSOFF][5
" "][RVSON][3" "][RVSOFF][4" "][RVSON][3
" "][RVSOFF][5" "][RVSON][3" "][RVSOFF][
5" "][RVSON][3" "]"                             JH
·920 PRINT" [RVSON]  [RVSOFF][4" "][RVSON
] [RVSOFF][5" "][RVSON] [RVSOFF][6" "][R
VSON] [RVSOFF] [RVSON] [RVSOFF][5" "][RV
SON] [RVSOFF][7" "][RVSON] [RVSOFF] [RVS
ON] "                                           BI
·922 PRINT"[PURPLE] [RVSON] [RVSOFF]  [RV
SON] [RVSOFF]  [RVSON] [RVSOFF] [RVSON][
3" "][RVSOFF] [RVSON]  [RVSOFF] [RVSON]
[RVSOFF] [RVSON] [RVSOFF] [RVSON][3" "][
RVSOFF] [RVSON][c *][RVSOFF] [RVSON] [RV
SOFF] [RVSON] [RVSOFF][3" "][RVSON][3" "
][RVSOFF] [RVSO
N][3" "]"                                       BE
·924 PRINT" [RVSON] [RVSOFF]  [RVSON] [RV
SOFF]  [RVSON] [RVSOFF] [RVSON] [RVSOFF]
[3" "][RVSON] [RVSOFF]  [RVSON] [RVSOFF]
 [RVSON] [RVSOFF] [RVSON] [RVSOFF] [RVSO
```

```
N] [RVSOFF] [RVSON] [c *] [RVSOFF] [RVSO
N] [RVSOFF] [RVSON] [RVSOFF] [RVSON] [RV
SOFF][3" "][RVS
ON] "                                   KM
•926 PRINT" [RVSON] [RVSOFF]  [RVSON] [RV
SOFF]  [RVSON] [RVSOFF] [RVSON]  [RVSOFF
]  [RVSON] [RVSOFF]  [RVSON][3" "][RVSOF
F] [RVSON] [RVSOFF] [RVSON] [RVSOFF] [RV
SON][3" "][RVSOFF] [RVSON][3" "][RVSOFF]
 [RVSON]  [RVSOFF]  [RVSON] [RVSOFF] [RV
SON] "                                  DH
•928 PRINT" [GREEN][RVSON]  [RVSOFF] [RVS
ON] [RVSOFF][4" "][RVSON] [RVSOFF][6" "]
[RVSON] [RVSOFF] [RVSON] [RVSOFF][5" "][
RVSON] [RVSOFF][c *][RVSON] [RVSOFF][5"
"][RVSON] "                             MA
•930 PRINTTAB(4)"[RVSON]  [RVSOFF][3" "][
RVSON] [RVSOFF][6" "][RVSON] [RVSOFF] [R
VSON] [RVSOFF][5" "][RVSON] [RVSOFF] [c
*][5" "][RVSON][3" "]"                  NK
•932 PRINT:PRINTTAB(14)"[c 1]BY JC HILTY"
:PRINT:PRINTTAB(12)"[BLUE]JOYSTICK-PORT
2":PRINT                                DC
•934 PRINTTAB(4)"[PURPLE]AVOID THE CROCOD
ILES AND HOOTIES"                       EO
•936 PRINT"[5"[DOWN]"][GREEN]"TAB(14)"PRE
SS ANY KEY"                             LJ
•938 FORX=0TO24:POKES+X,0:NEXT:RESTORE   HI
•939 POKES+3,8:POKES+5,41:POKES+6,89:POKE
S+14,117:POKES+18,16:POKES+24,143       IL
•940 READFR,DR:IFFR=0THENRESTORE:GOTO940 JB
•942 POKES+4,65                          AN
•944 FORT=1TODR:FQ=FR+PEEK(S+27)/2       FJ
•945 HF=INT(FQ/256):LF=FQAND255          LD
•946 POKES,LF:POKES+1,HF:NEXT:POKES+4,64 JB
•947 POKE2041,Z:POKE2042,Z:POKE2043,Z:Z=Z
+1:IFZ=196THENZ=192                     OO
•948 GETA$:IFA$=""THEN940                OF
•950 PRINT"[CLEAR]":POKEV+21,0:RETURN    IP
•1000 DATA 10814,2,5407,2,5103,2,5407,2,5
728,2,6430,2,7217,2,8101,2              PF
•1002 DATA 8583,2,5407,2,5103,2,5407,2,81
01,2,5407,2,4817,2,5407,2               CK
•1004 DATA 7217,2,5407,2,5103,2,5407,2,51
03,2,5407,2,5103,2,5407,2               DL
•1006 DATA 8583,2,5407,2,5103,2,5407,2,81
01,2,5407,2,5103,2,5407,2               BF
•1008 DATA 7217,2,5407,2,5728,2,6430,2,72
17,2,8101,2,8583,2,9634,2               HO
•1010 DATA 10814,2,5407,2,5103,2,5407,2,9
634,2,5407,2,5103,2,5407,2              JO
•1012 DATA 8583,2,5407,2,5103,2,5407,2,51
03,2,5407,2,5103,2,5407,2               OG
•1014 DATA 10814,2,5407,2,5103,2,5407,2,9
634,2,5407,2,5103,2,5407,2              MC
•1016 DATA 8583,2,7217,2,8101,2,8583,2,96
34,2,10814,2,11457,2,12860,2            FP
•1018 DATA 14435,4,14435,4,12860,2,14435,
2,12860,2,11457,2,12860,2               EJ
•1020 DATA 14435,4,10814,4,10814,8       EA
•1022 DATA 14435,4,14435,4,12860,2,14435,
2,12860,2,11457,2,12860,2               GN
•1024 DATA 14435,4,10814,4,10814,8       AL
•1026 DATA 14435,4,14435,4,12860,2,14435,
2,12860,2,11457,2,12860,2               BE
•1028 DATA 14435,4,10814,4,10814,4,9634,4 GJ
•1030 DATA 8583,4,5407,4,5103,4,5407,4,81
01,4,5407,4,5103,4,5407,4,0,0           LE
```

CLIFFHANGER.ML

Starting address in hex: C000
Ending address in hex: C0EC

Flankspeed **required for entry! See page 89.**

```
C000: A9 FF 2D 5C C1 F0 10 A9 9F
C008: 00 8D 5C C1 A2 15 BD C0 E9
C010: C1 9D 5C C1 CA D0 F7 A2 C3
C018: 01 A9 01 8D 10 C2 AD 10 E1
C020: C2 2D C0 C1 F0 03 4C 33 06
C028: C0 E8 E8 0E 10 C2 D0 EE 5B
C030: 4C 31 EA A9 00 1D C0 C1 E1
C038: D0 03 4C A1 C0 A9 80 3D 22
C040: C0 C1 F0 30 FE 5C C1 D0 D1
C048: 28 DE FF CF 4C D0 C0 50 4D
C050: C5 2D 10 D0 D0 0C AD 10 BE
C058: D0 0D 10 C2 8D 10 D0 4C C3
C060: 6B C0 AD 10 D0 4D 10 C2 3B
C068: 8D 10 D0 BD C0 C1 9D 5C 11
C070: C1 4C A1 C0 DE 5C C1 D0 AE
C078: 28 FE FF CF D0 1D AD 10 1B
C080: C2 2D 10 D0 D0 0C AD 10 EB
C088: D0 0D 10 C2 8D 10 D0 4C F3
C090: 9B C0 AD 10 D0 4D 10 C2 9B
C098: 8D 10 D0 BD C0 C1 9D 5C 41
C0A0: C1 A9 00 E8 1D C0 C1 D0 65
C0A8: 03 4C CC C0 A9 80 3D C0 AD
C0B0: C1 F0 0B FE 5C C1 D0 14 70
C0B8: DE FF CF 4C C6 C0 DE 5C 76
C0C0: C1 D0 09 FE FF CF BD C0 A9
C0C8: C1 9D 5C C1 CA 4C 29 C0 47
C0D0: A9 FF DD FF CF F0 03 4C 68
C0D8: 6B C0 AD 10 C2 4C 51 C0 E3
C0E0: 78 A9 00 8D 14 03 A9 C0 12
C0E8: 8D 15 03 58 60 47
```

CLIFFHANGER.SP

Starting address in hex: 3000
Ending address in hex: 323E

Flankspeed **required for entry! See page 89.**

```
3000: 00 00 00 00 00 00 02 00 02
3008: 20 00 80 80 00 22 00 00 4B
3010: 08 00 00 2A 00 20 AA 82 8F
3018: 08 59 48 02 79 E0 00 79 97
3020: C0 00 AA 80 00 2A 00 00 36
3028: 08 00 00 08 00 00 08 00 40
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 87 and 88 explain these codes and provide other essential information on entering ***Ahoy!*** programs. Refer to these pages **before** entering any programs!

```
3030: 00 00 00 00 00 00 00 00 30
3038: 00 00 00 00 00 00 00 00 38
3040: 00 00 00 00 22 00 00 22 84
3048: 00 00 22 00 00 22 00 00 8C
3050: 08 00 00 2A 00 00 AA 80 AD
3058: 00 59 40 2A DB 6A 00 DB 3E
3060: 40 00 AA 80 00 2A 00 00 F5
3068: 08 00 00 08 00 00 08 00 80
3070: 00 00 00 00 00 00 00 00 70
3078: 00 00 00 00 00 00 00 00 78
3080: 00 00 00 00 00 00 00 22 A2
3088: 00 00 08 00 00 22 00 00 B2
3090: 08 00 00 2A 00 00 AA 80 ED
3098: 00 59 40 02 79 E0 08 79 10
30A0: C8 20 AA 82 00 2A 00 00 E0
30A8: 08 00 00 08 00 00 08 00 C0
30B0: 00 00 00 00 00 00 00 00 B0
30B8: 00 00 00 00 00 00 00 00 B8
30C0: 00 00 00 00 22 00 00 22 05
30C8: 00 00 22 00 00 22 00 00 0D
30D0: 08 00 00 2A 00 00 AA 80 2E
30D8: 00 59 40 2A DB 6A 00 DB BE
30E0: 40 00 AA 80 00 2A 00 00 76
30E8: 08 00 00 08 00 00 08 00 01
30F0: 00 00 00 00 00 00 00 00 F0
30F8: 00 00 00 00 00 00 00 00 F8
3100: 00 00 00 00 08 00 00 2A 32
3108: 00 00 FF C0 02 AA A0 00 16
3110: D5 C0 00 D5 C0 00 15 00 52
3118: 00 04 00 00 AA 80 00 AA F1
3120: 80 00 AA 80 00 6A 40 00 76
3128: 0C 00 00 22 00 00 22 00 78
3130: 00 F3 C0 00 00 00 00 00 E4
3138: 00 00 00 00 00 00 00 00 38
3140: 00 04 00 00 04 00 00 04 4C
3148: 00 00 04 00 00 04 00 00 50
3150: 00 00 00 04 00 00 00 00 54
3158: 00 00 00 00 08 00 00 2A 8A
3160: 00 00 FF C0 02 AA A0 00 6E
3168: 22 00 00 F3 C0 00 00 00 3F
3170: 00 00 00 00 00 00 00 00 70
3178: 00 00 00 00 00 00 00 00 78
3180: 00 00 00 00 00 00 AA A0 CB
3188: 00 AA A0 00 80 20 00 80 F4
3190: 20 00 80 00 00 80 00 00 B1
3198: 80 02 40 82 22 C2 AA AA 18
31A0: AB AA AA AA AA AA 91 08 3B
31A8: 22 80 08 22 A2 08 20 AA EA
31B0: 08 20 00 0A 2A 00 00 00 0D
31B8: 00 00 00 00 00 00 00 00 B8
31C0: 00 3C 00 00 C3 00 03 42 06
31C8: C0 0C 24 30 0C 3C 10 07 49
31D0: 42 E0 04 FF 20 02 42 40 9C
31D8: 02 42 40 01 24 80 01 24 28
31E0: 80 00 A5 00 00 99 00 00 A0
31E8: 5A 00 00 5A 00 00 3C 00 D9
31F0: 00 3C 00 00 18 00 00 18 5D
31F8: 00 00 00 00 00 00 00 0B 04
3200: 00 00 00 33 00 02 59 00 8E
3208: 07 5D 6E D7 4D EA D7 7D 40
3210: AA D2 4D AE F0 EC 00 32 99
3218: 06 11 60 07 39 C0 03 90 24
3220: 00 00 F0 00 00 00 00 00 11
3228: 00 00 00 00 00 00 00 00 28
3230: 00 00 00 00 00 00 00 00 30
3238: 00 00 00 00 00 00 00 38
```

WARSHIP

FROM PAGE 16

```
·100 DEF FNJS(X)=PEEK(56464)ANDX:DEF FNFR
 (X)=A$=CHR$(13) OR A$=" " OR FNJS(16)=0  IN
·110 DEF FNUD(X)=(A$="[DOWN]" OR FNJS(2)=
 0)-(A$="[UP]" OR A$="[UPARROW]" OR FNJS(
 1)=0)                                    NE
·120 DEF FNLR(X)=-(A$="[LEFT]" OR A$="[BA
 CKARROW]" OR FNJS(4)=0)+(A$="[RIGHT]" OR
  FNJS(8)=0)                              FK
·140 FOR X=1 TO 30:RT$=RT$+"[RIGHT]":DN$=
 DN$+"[DOWN]":SQ$=SQ$+" ":NEXT:SO$="[10"
 "]"                                      JJ
·150 SP$=RT$+SO$:KL$=RT$+" KILLS: 0 ":AN$
 =RT$+" ANGLE: 45":WN$=RT$+" WIND[5" "]"  IB
·160 POKE 53280,0:POKE 53281,14:PRINT "[C
 LEAR][BLACK][RVSON]";RT$;" PLAYER 1 ";SP
 $;KL$;SP$;AN$;                           EC
·170 PRINT SP$;SP$;SP$;WN$;SP$;RT$;"  WAR
 SHIP [BLUE]";SQ$;"[BLACK] CF KAYLOR";SO$
 ;SQ$;                                    LB
·180 PRINT RT$;" PLAYER 2 ";SP$;KL$;SP$;A
 N$;SP$;SP$;SP$;WN$;SP$;SP$;              NO
·190 PRINT "[BLUE]";SQ$;"[BLACK][9" "][LE
 FT][INSERT] [HOME][c 8]";:FOR X=0 TO 9:R
 EAD C$(X),WN$(X):NEXT                    GP
·200 DATA "[RVSOFF] [DOWN][LEFT] ","[4"<"
 ]","[RVSOFF] [DOWN][LEFT][c P]"," [3"<"]
 ","[RVSOFF] [DOWN][LEFT][c O]","  <<","[
 RVSOFF] [DOWN][LEFT][RVSON][c U]","[3" "
 ]<","[RVSOFF] [DOWN][LEFT][RVSON][c Y]"  HE
·210 DATA "[4" "]","[RVSOFF] [DOWN][LEFT]
 [RVSON] ",">[3" "]","[RVSOFF][c P][DOWN]
 [LEFT][RVSON] ",">>  ","[RVSOFF][c O][DO
 WN][LEFT][RVSON] ","[3">"] ","[RVSON][c
 U][DOWN][LEFT] ","[4">"]"                BF
·218 DATA "[RVSON][c Y][DOWN][LEFT] ","[D
 OWN][LEFT][RVSON] [LEFT]":S=54272:FOR X=
 S TO S+24:READ A:POKE X,A:NEXT           NM
·220 PRINT LEFT$(DN$,9);SPC(15);C$(4);"[D
 OWN][LEFT][RVSON] [LEFT]";LEFT$(DN$,11);
 C$(4);"[DOWN][LEFT][RVSON] [LEFT][HOME]" NO
·240 DATA 0,2,0,0,32,0,199,0,3,0,0,128,0,
```

```
252,0,3,0,0,128,0,252,0,0,0,15                    MB
·250 IF PEEK(12351)<>199 THEN FOR X=12288
 TO 12543:READ A:POKE X,A:NEXT                     FE
·260 DATA ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
,,,,,,,,5,,,5,,,7,128,,7,128,,7,192,               LI
·270 DATA 255,255,255,127,255,254,127,255
,254,199,,,,,,,,,,,,,,,,,,,,,,,,,,,                KE
·280 DATA ,,,,,,,,,,,,128,,2,128,,2,128,,
7,192,,7,193,,7,227,224,31,255,192,15              HC
·290 DATA 255,192,199,,,,,,,,,,,,,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,,                        GL
·300 DATA 64,,,64,,1,196,,1,239,,7,254,,3
,254,,199,,,,,,,,,,,,,,,,,,,,,,,,                  EM
·310 DATA ,,,,,,,,,,,,,,,,,,,,,,,,,1,192,,
1,196,,7,255,192,15,255,224,199                    GL
·320 DATA  ,,,,,1,192,,1,196,,7,255,192,1
5,255,224,199                                      OJ
·340 AN(0)=45:AN(1)=45:V=53248:Q=RND(-TI)
 :FOR J=0 TO 1:REM POSITION SHIPS[BACKARR
OW][BACKARROW][BACKARROW]                          AK
·350 FOR K=0 TO 3:SH(J,K)=256*RND(1):X=J*
8+K*2:SD(J,K)=INT(900*RND(1))+100                  JK
·360 SH=J*4+K:POKE V+X,SH(J,K):POKE V+X+1
,117+104*J:POKE V+39+SH,0                          LL
·370 POKE 2040+SH,192+K:NEXT K,J:POKE V+2
9,255:POKE V+27,255:POKE V+21,255                  ED
·420 FOR PL=0 TO 1:SH=8*PL:PR=PL*13:REM P
LAY GAME[BACKARROW][BACKARROW][BACKARROW
]                                                  NA
·430 WN=4-INT(9*RND(1)):PRINT "[HOME][BLA
CK][RVSON]";LEFT$(DN$,8+PR);SPC(36);WN$(
WN+4)                                              ND
·440 GET A$:POKE S+4,32+SGN(FNUD(.)[UPARR
OW]2+FNLR(.)[UPARROW]2):BR(PL)=BR(PL)+FN
LR(.)AND255                                        AP
·460 POKE V+SH,SH(PL,0)+BR(PL)AND255:POKE
 V+SH+2,SH(PL,1)+BR(PL)AND255                      JO
·470 POKE V+SH+4,SH(PL,2)+BR(PL)AND255:PO
KE V+SH+6,SH(PL,3)+BR(PL)AND255                    EJ
·480 AN(PL)=AN(PL)+FNUD(.):AN(PL)=AN(PL)-
(AN(PL)=-1)+(AN(PL)=46)                            HF
·490 PRINT "[HOME][c 8]";LEFT$(DN$,9+PR);
SPC(15);C$(AN(PL)/10);                             JJ
·500 PRINT "[HOME][RVSON][BLACK]";LEFT$(D
N$,4+PR);SPC(37-(AN(PL)<10));AN(PL)                JC
·510 ON 1-FNFR(0) GOTO440:POKE S+4,32              HO
·520 POKE S+7,0:POKE S+8,3:POKE S+12,0:PO
KE S+13,250:POKE S+11,129:POKE S+11,128            LA
·540 AG=AN(PL)/13:FOR Y=8 TO AG STEP -1:P
RINT "[HOME][BLACK]";LEFT$(DN$,Y+PR);SPC
(15);"[s Q]";                                      JH
·550 FOR PA=1 TO 50:NEXT:PRINT "[LEFT] ":
NEXT:FOR PA=1 TO 1000:NEXT :FOR Y=AG TO
8                                                  MN
·570 PRINT "[HOME][BLACK]";LEFT$(DN$,Y+PR
);SPC(15+WN);".";:FOR PA=1 TO 50:NEXT:PR
INT "[LEFT] "                                      GL
·590 NEXT:SD=1000:SG=-1:FOR SH=0 TO 3:SI=
SH(PL,SH)+BR(PL)AND255:SE=SD(PL,SH)                BO
·600 IF SI>115+WN*8 AND SI<135+WN*8 AND S
E<SD THEN SG=SH:SD=SE                              OO
·610 NEXT SH:IF SG>-1 THEN640                      IE
·620 POKE S+7,0:POKE S+8,8:POKE S+12,63:P
OKE S+13,251:POKE S+11,129:POKES+11,128            ON
·630 PRINT "[HOME][BLACK][RVSON]";LEFT$(D
N$,6+PR);SPC(31);"MISS[5" "]":GOTO720              GE
·640 SF=(45-ABS(AN(PL)-45))*20+100:DS=SD-
SF:IF ABS(DS)>100 THEN690                          EM
·650 POKE S+7,92:POKE S+8,1:POKE 12,0:POK
E S+13,252:POKE S+11,129:POKE S+11,128             PL
·660 POKE V+21,PEEK(V+21)AND255-2[UPARROW
](SG+4*PL):SD(PL,SG)=1000                          JJ
·670 K(PL)=K(PL)+1:PRINT "[HOME][BLACK][R
VSON]";LEFT$(DN$,2+PR);SPC(37);K(PL)               CF
·680 PRINT "[HOME][BLACK][RVSON]";LEFT$(D
N$,6+PR);SPC(31);"HIT[5" "]":GOTO720               OB
·690 POKE S+7,0:POKE S+8,8:POKE 12,63:POK
E S+13,251:POKE S+11,129:POKE S+11,128             JF
·700 IF DS>0 THEN PRINT "[HOME][BLACK][RV
SON]";LEFT$(DN$,6+PR);SPC(31);"SHRT[4" "
][4"[LEFT]"]";DS                                   KD
·710 IF DS<0 THEN PRINT "[HOME][BLACK][RV
SON]";LEFT$(DN$,6+PR);SPC(31);"LONG[4" "
][4"[LEFT]"]";-DS                                  PL
·720 IF K(0)<4 AND K(1)<4 THEN FOR PA=1 T
O 1000:NEXT PA,PL:GOTO420                          PK
·730 IF K(0)=4 THEN PRINT "[HOME][BLACK][
RVSON]";LEFT$(DN$,6);SPC(31);"WINNER[3"
"]"                                                PB
·740 IF K(1)=4 THEN PRINT "[HOME][BLACK][
RVSON]";LEFT$(DN$,19);SPC(31);"WINNER[3"
 "]"                                               OH
·750 GET A$:IF FNFR(.) THEN750                     KH
·760 GET A$:ON 1+FNFR(.) GOTO760:RUN               JB
```

FUELING STATION
FROM PAGE 40

Starting address in hex: C000
Ending address in hex: C767
SYS to start: 49152

Flankspeed **required for entry! See page 89.**

```
C000: 20 81 FF A9 8E 20 D2 FF CC
C008: A9 08 20 D2 FF AD 14 03 71
C010: 8D 5A C7 AD 15 03 8D 5B 6E
C018: C7 A2 00 A9 01 9D 00 D8 A3
C020: 9D 00 D9 9D 00 DA 9D 00 AD
C028: DB E8 D0 F1 A2 00 A9 00 FB
C030: 9D C0 DB E8 E0 28 D0 F8 26
C038: A2 00 A9 0C 9D 70 DB E8 63
C040: E0 50 D0 F8 A9 0B 8D 20 9D
C048: D0 A9 00 8D 21 D0 A2 00 E4
C050: A9 20 9D 70 07 E8 E0 50 49
C058: D0 F8 A2 00 BD 30 C6 9D 17
C060: 40 03 E8 E0 3F D0 F5 A2 16
```

```
C068: 00 A9 28 8D 5C C7 A9 00 95
C070: 8D 59 C7 A9 0D 8D F9 07 64
C078: 8D FA 07 8D FB 07 8D FC 23
C080: 07 A9 00 8D 17 D0 A9 1E 6E
C088: 8D 1D D0 8D 1C D0 A9 07 2F
C090: 8D 26 D0 A9 02 8D 28 D0 47
C098: A9 0B 8D 29 D0 A9 09 8D 15
C0A0: 2A D0 A9 06 8D 2B D0 A9 7E
C0A8: 10 8D 10 D0 A2 28 8E 02 82
C0B0: D0 A2 78 8E 04 D0 A2 C8 6B
C0B8: 8E 06 D0 A2 19 8E 08 D0 41
C0C0: A9 C0 A2 07 85 FB 86 FC D9
C0C8: A9 C0 A2 DB 85 FD 86 FE BA
C0D0: A0 00 A9 A0 91 FB A9 0C FE
C0D8: 91 FD C8 C0 28 D0 F3 A2 81
C0E0: 00 BD 2F C7 9D C0 07 E8 E3
C0E8: E0 28 D0 F5 A9 2E A2 02 35
C0F0: A0 06 8D 21 04 8D 2A 04 06
C0F8: 8D 63 04 8D 83 04 8D A7 38
C100: 04 8D 16 05 8D 2F 05 8D FB
C108: E4 04 8E E4 D8 8D 5D 06 2E
C110: 8D 9E 06 8D DC 06 8D EA 2B
C118: 06 8D 00 07 8D 22 07 8C F5
C120: 22 DB 8D 6E 07 8D 88 07 3E
C128: A2 00 A9 00 9D 00 D4 E8 CF
C130: E0 18 D0 F8 A9 FF 8D 0F 39
C138: D4 A9 8F 8D 18 D4 A9 81 EB
C140: 8D 12 D4 AD 59 C7 D0 08 5C
C148: A9 01 8D 59 C7 4C 7C C1 2C
C150: C9 01 D0 0D A9 B2 8D E7 CA
C158: 07 A9 02 8D 59 C7 4C 7C 82
C160: C1 C9 02 D0 0D A9 B3 8D B6
C168: E7 07 A9 03 8D 59 C7 4C FE
C170: 7C C1 A9 B4 8D E7 07 A9 33
C178: 04 8D 59 C7 A9 B1 8D C7 DB
C180: 07 A9 B5 8D C8 07 A9 B0 9E
C188: 8D C9 07 20 7B C3 20 2C 92
C190: C4 A0 00 B9 6F C6 91 8B 03
C198: A9 05 91 8D B9 97 C6 91 10
C1A0: FB A9 05 91 FD C8 C0 28 8C
C1A8: D0 E9 A9 C6 8D 03 D0 20 55
C1B0: 31 C5 8D 05 D0 A9 C6 8D 09
C1B8: 07 D0 20 31 C5 8D 09 D0 0F
C1C0: A9 1E 8D 15 D0 A9 00 85 2B
C1C8: FB A9 00 85 FC A9 01 85 21
C1D0: FD A9 28 8D 5C C7 78 A9 74
C1D8: CE A2 C5 8D 14 03 8E 15 58
C1E0: 03 58 AD C7 07 C9 B0 D0 04
C1E8: 15 AD C8 07 C9 B0 D0 0E D4
C1F0: AD C9 07 C9 B0 D0 07 78 3A
C1F8: 20 79 C5 4C 69 C0 AD 03 7F
C200: D0 AE 5D C7 20 3F C5 29 F2
C208: FF 30 03 8D 5D C7 AD 05 A0
C210: D0 AE 5E C7 20 3F C5 29 04
C218: FF 30 03 8D 5E C7 AD 07 B3
C220: D0 AE 5F C7 20 3F C5 29 15
C228: FF 30 03 8D 5F C7 AD 09 C6
C230: D0 AE 60 C7 20 3F C5 29 26
C238: FF 30 03 8D 60 C7 AD 5D 2C
C240: C7 F0 14 AD 03 D0 38 E9 B0
C248: 01 AA AD 12 D0 C9 32 B0 31
C250: F9 8E 03 D0 4C 68 C2 AD D1
C258: 03 D0 18 69 02 AA AD 12 1A
C260: D0 C9 32 B0 F9 8E 03 D0 3A
C268: AD 5E C7 F0 0C AD 05 D0 BC
C270: 38 E9 01 8D 05 D0 4C 82 C5
C278: C2 AD 05 D0 18 69 01 8D CE
C280: 05 D0 AD 5F C7 F0 0C AD D5
C288: 07 D0 38 E9 02 8D 07 D0 E9
C290: 4C 9C C2 AD 07 D0 18 69 43
C298: 01 8D 07 D0 AD 60 C7 F0 C5
C2A0: 0C AD 09 D0 38 E9 02 8D E5
C2A8: 09 D0 4C B6 C2 AD 09 D0 CF
C2B0: 18 69 02 8D 09 D0 AD 03 4C
C2B8: D0 CD 61 C7 90 66 CD 62 A7
C2C0: C7 B0 61 AD 05 D0 CD 61 4D
C2C8: C7 90 59 CD 62 C7 B0 54 77
C2D0: AD 07 D0 CD 61 C7 90 4C 2A
C2D8: CD 62 C7 B0 47 AD 09 D0 50
C2E0: CD 61 C7 90 3F CD 62 C7 9F
C2E8: B0 3A 78 20 58 C4 AD 59 90
C2F0: C7 C9 04 F0 03 4C 43 C1 CB
C2F8: AD 5A C7 8D 14 03 AD 5B 76
C300: C7 8D 15 03 58 A2 00 BD 26
C308: D2 C6 9D 70 07 E8 E0 50 D0
C310: D0 F5 A5 91 C9 7F D0 03 2B
C318: 4C 66 FE A5 C5 C9 40 F0 30
C320: F1 4C 19 C0 4C E2 C1 A5 CE
C328: C5 C9 40 D0 03 8D 58 C7 79
C330: CD 58 C7 F0 45 C9 39 D0 28
C338: 0E 8D 58 C7 AD 5D C7 49 10
C340: 01 8D 5D C7 4C 7A C3 C9 48
C348: 38 D0 0E 8D 58 C7 AD 5E 19
C350: C7 49 01 8D 5E C7 4C 7A DC
C358: C3 C9 33 D0 0E 8D 58 C7 A5
C360: AD 5F C7 49 01 8D 5F C7 34
C368: 4C 7A C3 C9 00 D0 0B 8D 26
C370: 58 C7 AD 60 C7 49 01 8D 3E
C378: 60 C7 60 AD 59 C7 C9 01 9A
C380: D0 29 A9 40 85 8B 85 8D 88
C388: A9 05 85 8C A9 D9 85 8E E0
C390: A9 30 85 FB 85 FD A9 06 1F
C398: 85 FC A9 DA 85 FE A9 71 3F
C3A0: 8D 61 C7 A9 97 8D 62 C7 50
C3A8: 4C 2B C4 C9 02 D0 29 A9 54
C3B0: 68 85 8B 85 8D A9 05 85 71
C3B8: 8C A9 D9 85 8E A9 30 85 3C
C3C0: FB 85 FD A9 06 85 FC A9 1C
C3C8: DA 85 FE A9 79 8D 61 C7 02
C3D0: A9 97 8D 62 C7 4C 2B C4 06
C3D8: C9 03 D0 29 A9 68 85 8B C2
C3E0: 85 8D A9 05 85 8C A9 D9 38
C3E8: 85 8E A9 08 85 FB 85 FD B3
C3F0: A9 06 85 FC A9 DA 85 FE 2C
C3F8: A9 79 8D 61 C7 A9 8F 8D 99
C400: 62 C7 4C 2B C4 A9 90 85 26
```

```
C408: 8B 85 8D A9 05 85 8C A9 11
C410: D9 85 8E A9 08 85 FB 85 B6
C418: FD A9 06 85 FC A9 DA 85 52
C420: FE A9 81 8D 61 C7 A9 8F 3A
C428: 8D 62 C7 60 A2 00 A9 20 AC
C430: 9D 40 05 E8 E0 F0 D0 F8 97
C438: A2 00 9D 30 06 E8 E0 28 A0
C440: D0 F8 60 A2 02 38 BD C7 CC
C448: 07 F5 FB C9 B0 B0 02 69 D7
C450: 0A 9D C7 07 CA 10 EF 60 F1
C458: A2 00 BD BF C6 9D CC 07 B0
C460: E8 E0 13 D0 F5 A9 F0 8D 2C
C468: 06 D4 A2 FF 8E 00 D4 8E D7
C470: 01 D4 A9 15 8D 04 D4 20 8B
C478: 66 C5 CA 8E 01 D4 EE 26 E8
C480: D0 E0 00 D0 F2 A2 FF A9 42
C488: 0A 20 68 C5 CA 8E 00 D4 0F
C490: EE 26 D0 E0 00 D0 F0 A9 C2
C498: 00 8D 06 D4 A9 07 8D 26 65
C4A0: D0 A9 C8 20 68 C5 A9 C8 A4
C4A8: 20 68 C5 A9 14 8D 04 D4 1B
C4B0: A2 00 A9 A0 9D CC 07 E8 F7
C4B8: E0 13 D0 F8 60 A9 D9 85 DF
C4C0: 8C A9 DA 85 8E AD 59 C7 B4
C4C8: C9 01 D0 0B A9 40 85 8B 6A
C4D0: A9 30 85 8D 4C FD C4 C9 96
C4D8: 02 D0 0B A9 68 85 8B A9 83
C4E0: 30 85 8D 4C FD C4 C9 03 FF
C4E8: D0 0B A9 68 85 8B A9 08 99
C4F0: 85 8D 4C FD C4 A9 90 85 D2
C4F8: 8B A9 08 85 8D A9 00 8D 80
C500: 5C C7 AC 5C C7 A9 05 91 35
C508: 8B 91 8D EE 5C C7 C8 AD 3C
C510: 5C C7 C9 28 F0 09 A9 0D D6
C518: 91 8B 91 8D 4C 30 C5 A9 40
C520: 0D 8D 40 D9 8D 68 D9 8D 32
C528: 08 DA 8D 30 DA 8D 90 D9 9B
C530: 60 AD 1B D4 C9 3C B0 02 E6
C538: 90 F7 C9 C8 B0 F3 60 C9 22
C540: C8 90 05 A9 01 4C 53 C5 AE
C548: C9 3C B0 05 A9 00 4C 53 4D
C550: C5 A9 FF 20 60 C5 20 60 86
C558: C5 20 60 C5 20 60 C5 60 0B
C560: A0 B4 88 D0 FD 60 A9 19 30
C568: 8D 57 C7 A0 FF 88 D0 FD 0D
C570: CE 57 C7 AD 57 C7 D0 F3 EF
C578: 60 A2 00 BD 22 C7 9D CF 90
C580: 07 E8 E0 0D D0 F5 A9 F6 C5
C588: 8D 0D D4 A9 FF 8D 00 D4 04
C590: A9 04 8D 01 D4 A9 FA 8D D3
C598: 07 D4 A9 04 8D 08 D4 A2 2F
C5A0: FF A9 15 8D 0B D4 A9 0F 85
C5A8: 20 68 C5 A9 0A 20 68 C5 F8
C5B0: CA F0 06 8E 00 D4 4C AB CD
C5B8: C5 A9 00 8D 0D D4 A9 C8 0A
C5C0: 20 68 C5 A9 C8 20 68 C5 CF
C5C8: A9 14 8D 0B D4 60 48 8A 27
C5D0: 48 98 48 A5 91 C9 7F D0 4B
```

```
C5D8: 03 4C 66 FE AD 5C C7 C9 29
C5E0: 28 F0 06 20 02 C5 4C EF 24
C5E8: C5 20 BD C4 20 43 C4 20 99
C5F0: 27 C3 AD C7 07 C9 B0 D0 A3
C5F8: 0F AD C8 07 C9 B0 D0 08 D8
C600: AD C9 07 C9 B0 D0 01 78 43
C608: 68 A8 68 AA 68 4C 31 EA FC
C610: 46 55 45 4C 49 4E 47 20 3C
C618: 53 54 41 54 49 4F 4E 20 5C
C620: 4A 4F 48 4E 20 4B 52 55 63
C628: 54 43 48 20 31 39 38 37 02
C630: 00 00 00 00 00 00 00 00 30
C638: 00 00 00 00 00 00 00 00 38
C640: 00 00 00 AA 00 02 AA 80 18
C648: 0A AA A0 2A AA A8 2F BE 09
C650: F8 2A AA A8 0A AA A0 02 1E
C658: AA 80 00 AA 00 00 00 00 2E
C660: 00 00 00 00 00 00 00 00 60
C668: 00 00 00 00 00 00 00 43 AB
C670: 43 43 43 43 43 43 43 43 8A
C678: 43 72 43 43 43 43 43 43 C1
C680: 43 43 43 72 43 43 43 43 C9
C688: 43 43 43 43 43 72 43 43 D1
C690: 43 43 43 43 43 43 43 43 AA
C698: 43 43 43 43 43 43 43 43 B2
C6A0: 43 71 43 43 43 43 43 43 E8
C6A8: 43 43 43 71 43 43 43 43 F0
C6B0: 43 43 43 43 43 71 43 43 F8
C6B8: 43 43 43 43 43 43 43 86 16
C6C0: 95 85 8C 89 8E 87 A0 89 32
C6C8: 8E A0 90 92 8F 87 92 85 4A
C6D0: 93 93 A0 A0 A0 A0 A0 A0 BB
C6D8: A0 A0 A0 A0 8D 89 93 93 99
C6E0: 89 8F 8E A0 81 83 83 8F 41
C6E8: 8D 90 8C 89 93 88 85 84 43
C6F0: A0 A0 A0 A0 A0 A0 A0 A0 F5
C6F8: A0 A0 A0 A0 A0 A0 A0 A0 FD
C700: 90 92 85 93 93 A0 81 8E 80
C708: 99 A0 8B 85 99 A0 94 8F B1
C710: A0 90 8C 81 99 A0 81 87 92
C718: 81 89 8E A0 A0 A0 A0 A0 D4
C720: A0 A0 8F 95 94 A0 8F 86 D1
C728: A0 85 8E 85 92 87 99 85 9B
C730: 8E 85 92 87 99 A0 B1 B5 FF
C738: B0 A0 A0 A0 A0 A0 A0 A0 4D
C740: A0 A0 A0 A0 A0 A0 A0 A0 45
C748: A0 A0 A0 A0 A0 A0 A0 A0 4D
C750: 8C 85 96 85 8C A0 B1 00 5D
C758: 40 01 31 EA 0C 01 01 01 C4
C760: 00 71 97 00 00 00 00 00 69
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 87 and 88 explain these codes and provide other essential information on entering *Ahoy!* programs. Refer to these pages **before** entering any programs!

SPRITE-ON
FROM PAGE 70

```
·10 REM *** SPRITE-ON *** BUCK CHILDRESS
 ***                                      CB
·20 REM *** P.O. BOX 13575 SALEM, OR 9730
 9 ***                                    OA
·30 PRINTCHR$(147)"LOADING AND CHECKING D
 ATA LINE:":J=53000                       BN
·40 FORB=0TO11:READA                      MB
·50 IFB=0THENL=PEEK(64)*256+PEEK(63):PRIN
 TCHR$(19)TAB(31)L:PRINT                  PF
·60 IFA<0ORA>255THEN80                    FK
·70 POKEJ+B,A:X=X+A:D=D+1:NEXTB:READA:IFA
 =XTHEN90                                 PL
·80 PRINT"ERROR IN DATA LINE:"L:END       MG
·90 X=0:J=J+12:IFD<216THEN40              KE
·100 FORJ=12288TO12351:POKEJ,255:NEXTJ    DG
·110 PRINT"THE DATA IS OK[3"."]":PRINT    PD
·120 PRINT"SYS 53[3"0"] TO USE SPRITE-ON[
 3"."]":END                               NL
·130 DATA169,187,160,207,32,30,171,169,17
 0,141,0,208,1644                         FF
·140 DATA141,1,208,169,192,141,248,7,162,
 0,142,16,1427                            NE
·150 DATA208,232,142,21,208,32,126,207,17
 3,141,2,201,1693                         PI
·160 DATA4,144,6,232,208,253,200,208,250,
 165,203,201,2074                         NB
·170 DATA2,208,39,173,141,2,41,1,208,8,23
 8,0,1061                                 OF
·180 DATA208,240,16,76,37,207,206,0,208,1
 72,0,208,1578                            BN
·190 DATA192,255,240,3,76,37,207,173,16,2
 08,73,1,1481                             AN
·200 DATA141,16,208,76,37,207,201,7,208,1
 9,173,141,1434                           CK
·210 DATA2,41,1,208,6,238,1,208,76,37,207
 ,206,1231                                DO
·220 DATA1,208,76,37,207,201,63,208,184,9
 6,173,0,1454                             OD
·230 DATA208,133,251,160,9,32,143,207,173
 ,1,208,133,1658                          JG
·240 DATA251,160,28,162,1,24,32,240,255,1
 66,251,224,1794                          DC
·250 DATA100,176,12,169,32,32,210,255,224
 ,10,176,3,1399                           HD
·260 DATA32,210,255,173,16,208,240,5,169,
 18,32,210,1568                           BF
·270 DATA255,169,0,32,205,189,169,146,76,
 210,255,147,1853                         FM
·280 DATA32,32,32,32,32,88,32,80,79,83,73
 ,84,679                                  PM
·290 DATA73,79,78,32,32,32,32,32,32,32,32
 ,32,518                                  ND
·300 DATA89,32,80,79,83,73,84,73,79,78,0,
 0,750                                    PC
```

RUPERT REPORT

Continued from page 40

spaces and some comments. The simplest way to increase its speed is to reduce its functionality. Put REM statements at the start of lines 110 and 120 to eliminate the memory display and keyboard checking. These will produce a significant effect. Another possibility is to compile the program. If your compiler runs faster with integers than with floating point numbers (unlike the Commodore BASIC interpreter you are using), specify all numeric quantities to be integers. Also you might move the main loop subroutines closer to the top of the program.

What can Learner learn to do, and what are its limitations? Learner very quickly learns to follow a straight path of target cells. It doesn't seem to be able to turn corners (at least with the parameters given in this listing). By punishing the winning moves, it could possibly be taught to avoid the target cells. On the other hand, such techniques might give Learner a neurosis or other mental anomaly. Learner displays such traits that might be interpreted as senility (it forgets moves it once knew), as well as paranoia and autism.

You could experiment with various target shapes to influence Learner's behavior. Is there any continuous path it could learn to follow? Can you find oscillation chambers for it? Let me know what you discover. Hopefully you will find this to be quite a learning experience. ☐

SEE PROGRAM LISTING ON PAGE 92

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